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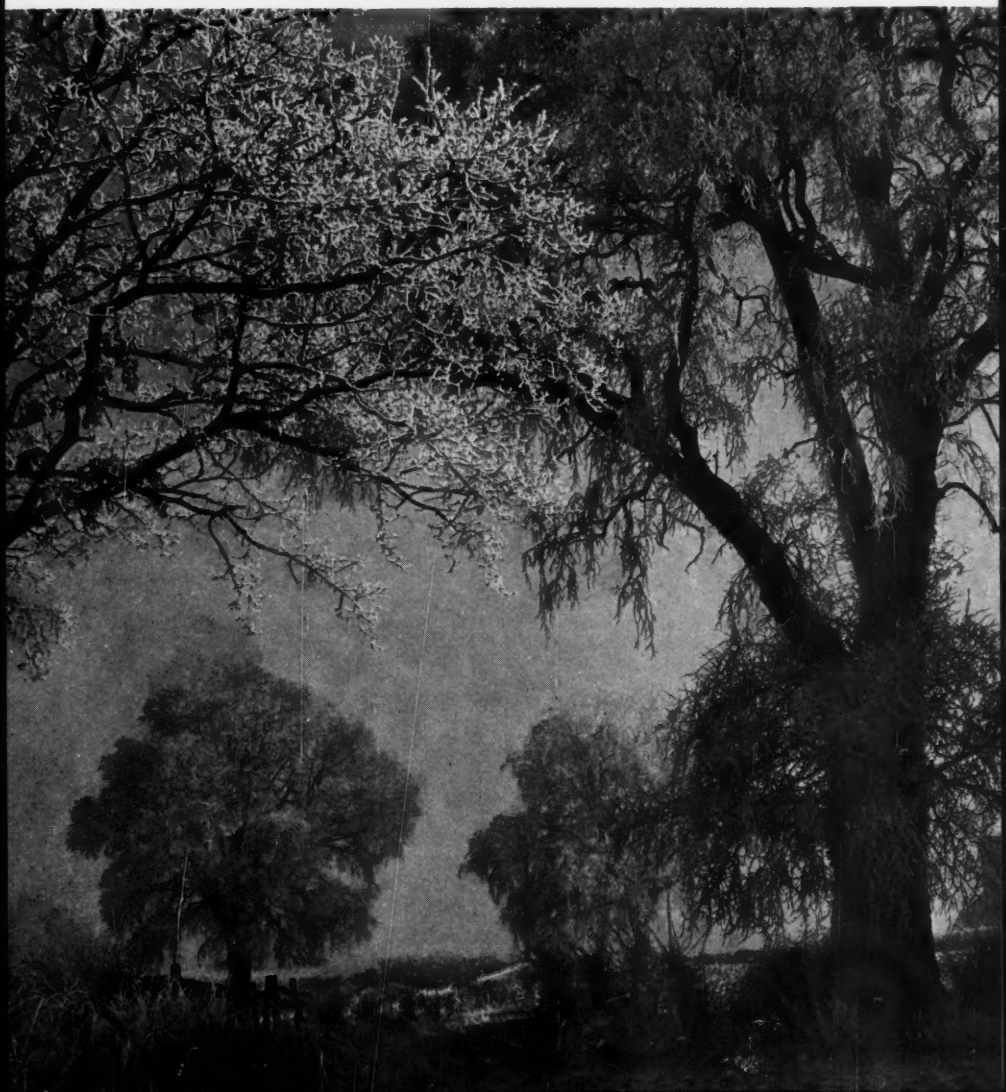

OFFICIAL APPOINTMENTS

General agriculturists and agricultural specialists of many kinds are frequently required in the effort to match the large demand from the developing countries. The vacancies advertised below are a selection from the many openings which exist now. While they are being filled, other vacancies are arising.

Salaries within the ranges quoted are assessed on qualifications and experience; and the terms of most appointments include free or subsidised accommodation, education grants, family passages, good leave on full pay, etc. A contributory pension scheme is available in certain circumstances.

Most appointments are limited to nationals of the United Kingdom or the Republic of Ireland who are normally resident in those countries.

BOLIVIA

Plant Pathologist

RC 213/22/07

Duties: To act as a consultant and to advise generally on plant disease problems affecting tropical crops; to submit a report with recommendations after a brief survey of the disease situation in the principal tropical crops, with special reference to Panama disease of bananas; and to work in consultation with the senior technical staff of the Ministry of Agriculture.

Qualifications and Terms: A degree in Botany, Agriculture or allied subject with specialisation in plant pathology and considerable experience of tropical crop pathology. Salary negotiable. Contract one month.

SARAWAK

Stored Products Entomologist

RC 213/155/02

Duties: To examine the whole process of collecting, harvesting and drying of the illipe nut so that suggestions may be made for improvements. Headquarters Kuching. Some travelling involved.

Qualifications and Terms: A degree in Natural Sciences with experience in stored products entomology. Salary negotiable. Contract 3 to 4 months.

Agricultural Economist

RC 213/155/03

Duties: To take charge of an Agricultural Economics and Statistical Organisation within the Department of Agriculture; to undertake surveys and census on agricultural crops and communities; to conduct marketing investigations as well as the collection and interpretation of statistical information on crops, markets, etc. and also cost benefit analysis of Land Development Schemes.

Qualifications and Terms: An Honours degree in Economics with a Diploma in Agricultural Economics (Oxon.) or equivalent which must include training in Agricultural Statistics. Post-graduate experience in agricultural survey work and agricultural marketing desirable. Basic salary $9,000—17,040 a year (£ Sterling 1,226—2,321 a year). An inducement allowance at present in the range of £ Sterling 739—1,206 a year is also payable. Terminal gratuity approximately 20% of basic salary and inducement allowance. 24-36 month contract.

OFFICIAL APPOINTMENTS

BOTSWANA

Pasture Agronomist

RC 213/19/02

Duties: To carry out, control and advise on a programme of range management investigations at two existing pasture research stations and to carry out ecological and vegetation surveys as part of a programme of assessing the natural resources of Botswana.

Qualifications and Terms: A degree in agriculture, preferably with experience of pasture research in arid areas. Basic salary scale RS. 2,256 to RS. 4,440 (£1,316 to £2,590) a year. An inducement allowance at present in the range £156 to £336 a year is also payable. Tax free gratuity of 25% of basic salary and inducement allowance. Two to three years contract.

Agricultural Officer (Headquarters)

RC 213/19/03

Duties: To assist the Director and Deputy Director of Agriculture in the administration of the Department of Agriculture.

Qualifications and Terms: A degree in agriculture with several years' experience of administration at provincial or territorial level. Basic salary scale RS. 2,256 to RS. 4,440 a year (£1,316 to £2,590). An inducement allowance at present in the range £156 to £336 a year is also payable. Tax free gratuity of 25% of basic salary and inducement allowance. Two to three years' contract.

EAST AFRICAN COMMON SERVICES ORGANISATION

Cytogeneticist/Plant Breeder

RC 213/214/02

Duties: Required as a member of a five-man team working on sorghum and millet breeding and development at Serere, Uganda.

Qualifications and Terms: An honours degree in Botany or Agricultural Botany and not less than two years' postgraduate experience. Basic salary scale £ East African 1,128—1,494 p.a. (£ Sterling 1,316—1,743 p.a.), subject to Uganda income tax. In addition, an allowance, normally tax free, at present in the range of £ Sterling 744—852 p.a. will be paid by the British Government on behalf of the East African Common Services Organisation to an officer's bank account outside East Africa. 25% terminal gratuity. Two years' contract, with prospects of renewal for a similar period.

TANZANIA

Agricultural Officers (Land Utilisation)

RC 213/173/026

Duties: To undertake land surveys and advise on their suitability for agricultural development and other duties.

Qualifications and Terms: A degree in agriculture, with soil science as a major subject, a knowledge of land techniques and experience of survey equipment. Salary ranges from £ Tanzanian 716—1,650 a year (£ Sterling 835—1,925) liable to Tanzanian income tax. In addition, an allowance normally tax free, at present in the range of £ Sterling 672—1,020 a year is also payable by the British Government direct to an officer's bank account outside East Africa. Terminal gratuity of 25% of basic salary and allowance. Contract 21-27 months in the first instance.

If you wish to apply for any of these appointments, or you are interested generally in an appointment overseas, please write giving your full name, age and brief particulars of your professional qualifications and experience to the:

Appointments Officer
MINISTRY OF OVERSEAS DEVELOPMENT
Room 324a, Eland House, Stag Place,
London, S.W.1.

MINISTRY OF OVERSEAS DEVELOPMENT

Agriculture

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Ministry of Agriculture, Fisheries and Food
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AGRICULTURE FEBRUARY 1968

The foot-and-mouth epidemic has caused a tremendous upheaval and disorganization of plans on the farms that have been affected. Such an event is tragic but it can be turned to advantage, because it can be a time for looking critically at the farm and one's own future plans. All the Ministry's Advisory Services are anxious to help in whatever way they can, so why not discuss your problems with your District Agricultural Adviser.

Restocking after Foot-and-Mouth Disease

J. Gibbons K. B. Mosdell

THE first outbreak of the recent foot-and-mouth epidemic occurred near Oswestry in West Shropshire, in a semi-upland livestock rearing area; but it fanned out from there mainly in a northerly and easterly direction spreading into parts of Wales and across north Shropshire and the Cheshire Plain. The disease spread to a number of neighbouring counties and there have been pockets elsewhere. Both small and large farms have been affected, livestock rearing farms and mixed farms; but the vast majority have been dairy farms, and a high proportion of these all grass.

One is inclined to talk statistics on such occasions: over 2,300 outbreaks, more tha 415,000 animals slaughtered. If one looks at these figures in relation to the numbers of livestock in the country as a whole it does not appear to present any long-term major problem of building up the national herd again to get back to normal. But the statistics are made up of individual farms and farmers, and the problems are individual problems; and they are concentrated in certain areas. The figures may only represent a small percentage of the total livestock; but a very much higher percentage of Cheshire's dairy cows have been slaughtered, and whole areas have been almost denuded of farm animals.

Only those who have suffered the tragic loss of their stock through foot-and-mouth disease can know its full impact in terms of shock and upheaval

and disorganization of plans, and in some cases of a life's work of breeding destroyed in a few hours; and after the first stunning blow, the slow climb back to normal.

Such an event becomes one of life's milestones—in this case a tragic one; and yet it can be turned to some advantage because it can be a time for looking critically at the farm and its policy and one's own future plans. Does it present the opportunity for making changes which one had long considered but never got round to implementing? For the older man, is this the point at which to retire rather than face all the difficulty of restocking? It might be worth while inquiring about the retirement grants which are now available in certain circumstances. For the younger man, was the old system of farming being followed best for the circumstances of today, or does this present the opportunity of switching to a different system of farming, for example an arable system in place of dairy cows? Is there a case for a co-operative venture with two or three other people in the same position as yourself? These are all questions which are worth asking, and advice is available through your District Agricultural Adviser. For the large majority, however, the answer will undoubtedly be that the farm was being farmed on a suitable system for the circumstances, and getting back to that system must be the main objective. Nevertheless a quick rush back into full stocking with the maximum number of cows in the spring of the year, with prices high in consequence of shortages, may not necessarily be the best policy. What are the alternatives?

Re-stocking

The capital position of farms will vary and will largely dictate the speed at which re-stocking need be contemplated. Many will be faced with continuing financial commitments, such as mortgage payments, rent, interest on bank borrowings, wages to skilled workers; and the extent of these will help to determine the necessity or otherwise for immediate income.

There are three further factors which ought to make one cautious in stocking up again, i.e.,

1. The difficulty of finding the right stock
2. The high prices which may be asked
3. The problem of getting the new herd into a satisfactory pattern of calving.

To tackle these problems probably means 'shopping around' and building-up gradually, buying perhaps some newly-calved cows, some in-calf cows, some bulling heifers, and probably deferring some of the purchases until later in the year. Those who decide to purchase a part of their replacements immediately may perhaps be worried at the prospect of having spring-calving cows. With present milk prices, and provided a reasonable amount of milk can be taken from grass, then the 'margin over concentrates' between spring and autumn calvers is not very great:

Spring calving	£	*Autumn calving*	£
850 gallons	128	850 gallons	144
Less concentrates	30	Less concentrates	44
Margin	98	Margin	100

The largest unknown factor is depreciation. If replacement cows are expensive, then it seems likely that much of the depreciation will occur during the first twelve months, and farmers not anxious for immediate income may be as well off by delaying their purchases. This may mean, of course, that there is land on the farm surplus to the livestock requirements during the coming summer.

Using the surplus land

As to what is the best use that can be made of the land surplus to the livestock requirements depends a good deal upon the particular circumstances. Three possibilities come readily to mind:

1. Buying or agisting store cattle and/or sheep
2. Making hay
3. Growing cereals

Prices of stores always tend to rise in the spring of the year, and this year in particular, with large numbers of people attempting to buy in the store market, there is a distinct possibility that prices will be unusually high, making the returns at the end of the season even poorer than they are in normal circumstances with the system. It is, in any case, essentially a low-output system and could not be more than a very temporary stop-gap on a dairy farm.

Making extra hay could be one fairly simple solution to the problem, provided equipment and labour are likely to be available and always, of course, that the weather is kind at haymaking time! Again the return per acre is not very great; a gross margin say of £15 per acre is what one would normally expect, and to get the best return it would be undesirable to have to sell in the autumn, when there may be a good deal of extra hay about and smaller numbers of livestock. If the hay could be held until there is a suitable market this would be a good investment, although many people will be faced with the problem of requiring the capital for other purposes.

Increasing the cereal acreage temporarily

Probably the most profitable of the alternatives available is to grow cereals, where this is possible. If the intention was to restock fairly quickly these could be undersown so that the areas would be in grass again for 1969. Some of the affected farms are already equipped to grow and harvest cereals, and increasing the acreage would be easy and profitable. Natural attributes of the farm may determine the acreage that can be grown. Others will have to decide the acreage that can be managed, bearing in mind that it may be a new venture with a risk element attached, particularly where most of the acreage is undersown. Some, while having suitable land will have no equipment. There may be contractors who will undertake the job; alternatively, most farmers have a tractor and might be able to borrow tackle. It is important to make sure that a combine will be available at harvest time, and that the corn can be either dried and stored or sold direct from the field. The possibility of a number of farmers getting together to buy new or even secondhand equipment would be worth considering.

With the £10 per acre grant which is now available, the economics of corn growing at even a modest yield level are reasonably attractive, as shown in the following example with barley:

Output:		£
30 cwt of grain		33
Grant		10
	Total	43
Variable costs:	£	
Seed	3·2	
Fertilizer	2·0	
Sprays	0·9	
Combining	3·5	
Half share of seeds	2·5	
	12·1	12·1
Gross margin per acre		30·9

If a contractor has to be employed for some of the cultivations and drilling, then these figures must be deducted from the above margin.

Other cash crops

On the larger type mixed farms, in addition to an increase in the cereal acreage, there may well be the opportunity for a modest increase in other cash crops such as potatoes, sugar beet and vegetables. The question of quotas as far as potatoes are concerned and contracts for sugar beet would need to be taken into account, and with vegetables one would need to be reasonably sure of a satisfactory market.

Gross margins per acre for potatoes and sugar beet in the region of £72 and £57 respectively could make a useful addition to farm income. Again, details regarding labour supply, harvesting machinery and storage facilities must be taken into account.

Livestock rearing and sheep farms

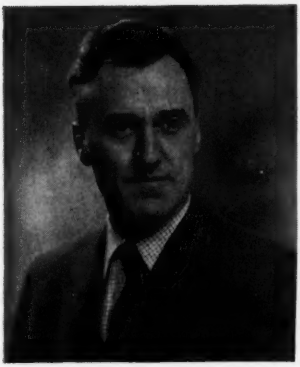
A number of the farms which have been affected by foot-and-mouth disease are livestock rearers rather than milk producers. Their problems are rather different from those of the dairy farmer. Income has mainly come from the sale of suckled calves, other store cattle, lambs and wool, with the major part of the sales coming in the autumn. With the breeding stock slaughtered, the difficulty of lack of income will become apparent. Much of the re-stocking will, of necessity, be left until the autumn. In the meantime, to make use of the land and to generate income it may be possible to plough a small part for cereals and utilize the remainder by the purchase of such store stock as is available at worthwhile prices.

Seeking advice

An article such as this can only touch the fringe of the real problems affecting the individual farmer. The best steps to take must be settled for the man and the farm, and decisions can only be made in the light of all

the particular circumstances. All the Ministry of Agriculture's Advisory Services are anxious to help in whatever way they can, and the N.A.A.S. in particular is available to help in replanning and to assist the farmer in deciding what are the best steps for him to take in his own interests in his particular circumstances, not only as to what is technically possible, but also what will be the probable financial consequences of various alternatives. The first point of contact is your District Agricultural Adviser who will be prepared to discuss all these problems with you in confidence.

J. Gibbons, M.Sc., is the Deputy Regional Director for N.A.A.S. in the West Midland Region; his co-author, **K. B. Mosdell, M.A.,** is the Farm Management Adviser for the same Region.



Potatoes and Herbicides

Stanley Evans

In 1963 one acre of second early and maincrop potato in every hundred was sprayed with a chemical weed-killer; in 1966 one acre in five was sprayed. Usage is still increasing. And yet it is easy to remember the day when to ask for a herbicide for potatoes was tantamount to admitting bad husbandry. Tradition demanded rigorous cultivation of the crop after planting and weeds in these circumstances were of little trouble.

Herbicides and cultivations

Research before the second world war showed that the advantage of inter-row cultivations was mainly in controlling weeds and not in stimulating crop growth and improving yield, although with the introduction of mechanical harvesting machines they may also have the added advantage of ameliorating the soil to ease the lifting of the crop. Since the introduction of herbicides for potatoes many crops have been grown satisfactorily without such cultivations; what is more, some appreciable yield increases have been recorded due to their omission. Growing awareness that it is possible to reduce yields by inter-row cultivations has led to a general reduction in both their severity and frequency; and their abandonment in favour of weed-killers has become increasingly acceptable.

Substitution of cultivations by weed-killers does not always improve yield. Cultivations are not necessarily detrimental: much must depend upon what is done and the condition of the soil at the time. Generally, herbicides used correctly are safe on crops but residual herbicides, which are applied to the soil where they persist for several weeks may, occasionally, under some conditions, themselves reduce the crop. The efficiency with which either cultivations or herbicides are used and the control of weeds they achieve will affect the crop. Comparison of the effects of cultivations and herbicides involves a complexity of factors and under what conditions yield improvements can be achieved by substituting herbicides in place of cultivations is not at all clear.

Yield is only one factor in profitability. Production costs can be substantially increased by the use of manual labour for the removal of soil clods from the crop at harvest, an operation which at present is not fully mechanized. Several systems of producing clod-free soil have been devised including the so-called 'Dutch' cultivations and rotary ploughs and ridgers. It has been shown that clods can be formed in the soil by the normal passage of tractor and cultivator through the crop. Herbicides, by eliminating the need for such cultivations, can therefore also alleviate the problem. But again the use of herbicides does not automatically bring into train its possible attendant advantages. Lack of clods at harvest depends upon the ability to produce a clod-free soil by planting time and also a type of soil which without cultivation will not run together and be broken up into clods by the harvester.

The quantity and quality of tubers produced by a crop can be manipulated to some extent by the size of seed tubers planted and the pattern in which they are planted. Without the need to cultivate along the rows it is possible to consider if there are any practical advantages to changes from the commonly used 28–30 inch rows. The use of 'beds'—for example three rows closely spaced on a raised bed between tracks for tractor wheels—have been tried. It seems however that the potato plant is very adaptable and that yields of maincrop potatoes suitable for the ware market cannot be appreciably improved by altering planting patterns. For the production of seed or early potatoes there may be some advantage and a few commercial crops have been grown in beds. Beds, however, bring their own problems, such as the greater difficulty of harvesting the produce and the tendency for a greater proportion of tubers to become green. Irrigation may be necessary to avoid serious water stress in closely planted potatoes. So far, the introduction of herbicides has had little influence on planting practices. Rather there is a tendency in the East of England for row widths to be increased up to 36 inches to accommodate the cultivator better.

Herbicide use

Two main types of herbicide are available. First, contact herbicides are used to scorch off the seedling weeds which emerge before the potato and they are usually applied, therefore, just before the potato crop emerges. These have little or no residual activity so that weeds germinating after spraying grow away freely. Secondly, there are the residual herbicides which, applied to the soil surface, remain there for some time killing off successive growths of seedling weeds. These types of herbicides currently in use also

have a contact action and can kill seedling weeds; they can, therefore, also be applied up to just before crop emergence.

Contact herbicides scorch the leaves of potatoes which have emerged and this set-back can be reflected in a delay in bulking of tubers. This may not be important where the crop has a long growing season in which to recover but may be a marked disadvantage in early crops.

Some residual herbicides, at least, can be even more damaging if the potatoes are through the ground when sprayed. Appreciable yield reductions have been recorded from using linuron after emergence even where the crop has grown well to the end of the season. The safety of these herbicides depends upon spraying before the crop has come through and in appreciable measure upon the chemical subsequently remaining near the surface of the soil where the crop roots are unlikely to pick it up. Under some conditions the chemical may penetrate the soil more deeply, for example, on light sands or under conditions of high rainfall or where over-dosing has occurred. To avoid this danger the tendency has generally been to put a fairly substantial ridge over the newly-planted tubers. Whilst this has seemed satisfactory for many varieties it is unlikely to be so with a variety like Pentland Dell which may emerge from a depth of soil only with difficulty.

Herbicide mixtures

Residual herbicides are fairly costly and at normal doses the price can reach as high as £5 or £6 an acre. A reduction in dose would therefore contribute not only to crop safety but to a lessening of cost. This can be achieved by partial substitution of a residual herbicide with a contact herbicide. On the farm crops at the Weed Research Organisation, for example, a mixture of 6 oz of linuron and 6 oz of paraquat per acre has given good results on the light soils there. This probably represents about the lowest limit to which it is possible to go and will certainly not be adequate for all soil types or weed populations. But it does show that cost can be brought down—and in this instance to as little as about 36*s*. per acre.

At the time of writing such mixtures are commercially available in Scotland only; elsewhere, growers must be prepared to use them without the backing of the trade.

Need for thoughtful use

The cost of cultivations is usually regarded as negligible, certainly much less than the top prices paid for herbicides. The farmer who uses herbicides might then be reducing his profit. To avoid this he should have a clear idea of the advantage he expects and aim to get it. The profit may not be in lack of clods or better yields of the potato crop itself. Labour released from potato cultivation may be more profitably employed elsewhere. The grower may count the money well spent to allow him to forget about cultivations in the crop. In Britain's uncertain climate the spraying of a crop may be a simpler managerial problem than that of carrying out several cultivations. In a wet year the weed control from herbicides may be better than that from cultivations (which may or may not be important) and it is interesting to note that herbicide use is appreciably greater in the west than in the drier eastern parts of the country.

The use of a herbicide demands planning. Contact herbicides are likely to be of real value only when the weeds are encouraged to germinate before the crop is through. This generally means avoiding cultivations once the

crop is planted. Even so, with the planting of chitted seed, the crop may emerge before there has been time to kill the main flush of weeds. Residual herbicides are likely to be most satisfactory when used on soils of good tilth undisturbed since planting. Thus seedbed preparations need to be thorough. Amelioration of the soil by post-planting cultivations is not usual, although there is some interest in using a residual herbicide after such cultivations to avoid the need for further work once the crop is through the ground. Erosion of ridges can carry herbicides away from the top of ridges leading to poor weed control so a rounded form of ridge is required. Sharp ridges must be avoided. None of the weed-killers control perennial weeds and they should not be used where such weeds are present and likely to be troublesome.

The farmer has no real alternative weed-killer to those used pre-emergence. There is no satisfactory weed-killer for use on the growing crop although MCPA is fairly widely used. This treatment cannot be considered as other than for use in an emergency because it has been known seriously to affect yield. The use of herbicides in potatoes, then, needs planning and to be profitable they should be used to a purpose.

Weed-killer	Type of action	Dose range lb active ingredient per acre	Approx. cost per acre
			£
Paraquat/diquat	C	0·5—1·0	1·5—3·0
Pentachlorphenol	C	3·0—4·0	2·0—3·0
Dinoseb-in-oil	C + R	2·5	2·5
Linuron or monolinuron	C + R	0·75—1·75	2·5—5·0
Linuron + monolinuron	C + R	1·0—2·0	3·25—6·5
Ametryne	C + R	1·3—2·0	2·75—4·0
Prometryne	C + R	1·5	3·75

C = contact. R = residual.

This article has been contributed by **Stanley A. Evans, B.Sc., Dip. Agric.,** who is the N.A.A.S. Liaison Officer with the Agricultural Research Council's Weed Research Organisation at Kidlington, near Oxford.

Labour Organization on the Farm

J. S. Nix

GROSS margins have come under heavy fire during the past twelve months. Most of the criticism has been ill-informed, but if it causes farm management teachers and advisers to re-examine their own basic understanding of the concept, to be more aware of its possible dangers in inexpert hands, and to take more trouble in explaining to farmers the economic reasoning that underlies it, then it will have served a useful purpose. Certainly it is a healthy sign that the so-called 'fixed costs'—particularly labour and machinery—have received an increasing amount of attention during the last year. In many farm situations they may indeed be difficult to alter, but in others—and especially on larger farms—there may be more scope for improving net farm income by careful scrutiny of labour and machinery costs than by trying to improve further the total farm gross margin.

Excluding small and highly intensive farms, the fixed costs (i.e., regular labour, power and machinery, rent, and general overheads) usually comprise between 50 and 60 per cent of gross output. Labour and machinery together normally account for nearly three-quarters of the fixed costs, or between 35 and 40 per cent of gross output. Over the past ten years, the hourly wage-rate has risen by nearly two-thirds, while the average level of prices, including price subsidies, has hardly altered. Partly as a result of this economic pressure, the regular labour force in United Kingdom agriculture in June, 1966, was 225,000 lower than the June, 1956, figure of 650,000. Labour has been leaving the land still more rapidly during the past year, the exodus being even faster than the rate assumed in the National Plan, which many criticized at the time as being unrealistically high.

Efficiency measures

A starting point in considering labour organization is to use one of the efficiency factors employed in accounts analyses. These can be measured either in financial or physical terms, or a combination of the two. Net Output per £100 Labour and per £100 Labour and Machinery are frequently used. A typical average figure for the former is £350, with £450 a 'premium' result, but such standards obviously vary according to size and type of farm and soil. Thus, for a large mainly cereal-growing, light land farm the figures are £500 average, £650 premium. Typical figures for Net Output per £100 Labour and Machinery would be £225 average, £275 premium. Gross output should

not be used for these comparative measures, and the value of unpaid manual labour must be included in labour costs.

Financial output, however, can be affected by many factors, both environmental and managerial, that have little or nothing to do with labour efficiency. In many ways, therefore, it would be preferable to use standard output. An alternative way of overcoming the problem is to use a physical measure. This is described as the Labour Efficiency Index, or Man-Work Unit Index, and compares the number of man-work units (or standard man-days) theoretically required by the farm with those actually employed. If such measures are to retain any validity, the man-day requirements of each crop and type of livestock must be kept up to date and varied according to production methods. Another measure—one that avoids the problem of deciding how many annual man-days are provided by each worker and takes into account differing wage-levels—is Labour Cost per 100 Standard Man-days. A typical average figure is £210, with £175 the premium level.

In terms of economic theory it is easy to criticize these measures. In particular, they are primarily ratios depicting average relationships, whereas it is what happens at the margin that is important in business decision-making. Nevertheless, they can be a useful starting point for an investigation of labour efficiency, provided they are interpreted sensibly, in combination with other efficiency measures and a full knowledge of the farm situation, including physical, financial and human factors.

Labour planning

However, neither efficiency measures nor the man-day concept are of much use for planning improvements. The farmer needs to know, not simply that his labour use appears to be excessive, but what he should do about it. Numerous factors have to be taken into account: the type, condition and layout of the buildings, the size and type of tractors and other machines available, seasonality, the availability of casual labour, contractors and capital, soil type, the amount of overtime the men are prepared to work at busy times, and the flexibility of the cropping and stocking programme.

For livestock the number of stockmen needed can be determined by examining the number of stock, the buildings available and the work methods employed. Standard data derived from work study investigations can be utilized. For crops and grass the emphasis must be not on annual requirements but seasonal needs. In farm planning, July labour is as different from October labour as fertilizer or any other input. The type of soil and machinery available are also crucial.

For estimating seasonal labour requirements the type of labour profile showing total man-hours per month is gradually being superseded by the gang-work day chart, first developed in the Eastern Counties. This is more meaningful and of more practical value to the farmer because it deals in terms of specific numbers of men employed on specific tasks for specific periods at different times of the year. When the specialist barley-grower thinks of the number of men he needs his mind works in terms of the number required to complete the spring drilling by a certain date and to get the harvest in, not in terms of man-hours per month.

For each task, the number of men needed, the rate of work and the acres of the crop being grown will give the number of gang-work days needed.

The time available, usually measured in 'eight-hour day equivalents', allowing for bad weather and overtime, will complete the minimum amount of information needed for calculating what size of staff is required for a given cropping programme. One would not normally expect the farm plan and level of mechanization necessarily to remain fixed. To provide a better overall plan changes may be needed in crop acreages, the size and type of tractors and other machines, and the use of casual labour and contractors. Linear programming can be used to suggest optimum plans for different numbers of regular workers on the same farm.

Data requirements

The adviser is better equipped with techniques than he is with data, which often prove to be the limiting factor. The choice lies between data obtained from the farm being planned and standard data. It is rarely possible to get information from the farm in sufficient detail. Standard data are available, and can be a useful guide, but again are often not obtainable in the detail required to relate to a specific farm situation. Therefore the farm planner has to choose between what he can glean from the farmer's memory and usually inadequate records, and rather generalized standard data suitably amended to fit the farmer's specific conditions, using his own judgement and experience. More often than not it is necessary to blend the two.

In an ideal farm planner's world the following information would be available for each farm task:

1. *Rates of work* (for a given gang size) for different types and size of tractor and implement, and for different soil types and conditions.
2. *The time available* on each soil type—the earliest and latest dates, together with the average number of days within the period on which the work is possible, allowing for bad weather.
3. *The year-to-year variations*, both as regards first and last dates and workable days.
4. *The effect of delays* on the yield and quality of the crop.

The first two items are basic. The third would enable the risk element to be taken into account. The fourth would allow the cost of extra men or bigger machines to be compared with the benefits of added timeliness of operation.

Such an ideal is never likely to exist, if only because techniques change so fast and the diversity of soil types and local climatic conditions are so great. Nevertheless it must be both possible and desirable to improve on our present position, unless one is to pay lip-service only to the concept of detailed farm planning and leave everything to individual experience and good faith. Thankfully, the individual judgement of the farmer or farm manager will never be completely superseded, but it should be possible to give him more assistance than he has now. Valuable efforts are currently being made to help supply more information of the type needed, but these will never be sufficient until a group of research workers is entrusted with the full-time task of providing data and keeping them up to date. In terms of the country's total research and advisory programme the cost would be insignificant, but the practical benefits would be inestimable.

The human factor

It is not only in the physical and financial aspects of farm labour that leading farmers and managers are showing an increasing interest. It is also in the psychological or human aspects—the sphere of labour relations. Someone once said, 'The biggest problem with industry is that it is full of human beings'. Anyone who has ever had to administer staff will appreciate this statement. Increasingly, farmers and managers are finding their major worry to be, not some intractable problem of husbandry or economics, but obtaining and retaining a competent and co-operative farm staff.

In most areas the time has long past when there were large numbers of fairly passive and apparently contented workers about, seemingly not particularly interested or even aware of what went on outside the farm on which they worked for their whole lives. Over large parts of the country farm labour, and especially skilled labour, is becoming scarce, and the men are aware of the fact. The younger men, in particular, are more mobile. If not properly treated, they know there are other farmers only too willing to have them, and they well realize that in the towns they can usually earn more money working shorter hours and displaying a minimum amount of skill. Although for many of them this would be a last resort, their wives might persuade them differently.

Rex Paterson has many times demonstrated the value of a good stockman. The cowman can quite easily make a difference of £15 a cow in margin of milk sales over concentrates; in a modern, one-man dairy this is £1,000 a year or more—virtually equivalent to his earnings.

Within what seems to be a short space of time a whole new field of study has developed—the so-called 'behavioural sciences'. It is now one of the most flourishing and rapidly expanding fields of academic attention in the business world. Most of the work has emerged from the universities and business schools of the United States. A recently published book *Human Relations in Management* runs to no less than 870 pages. Unfortunately, social sciences such as psychology, sociology, social psychology and applied anthropology can rarely supply cut-and-dried answers to our problems. What they endeavour to provide are new methods of analysing and understanding human relationships. Some might argue, no doubt with a large element of truth, that a good manager of men is born and not made. Nevertheless, there is much to be learnt by everyone from this developing branch of knowledge.

Motivation and communications

In particular, a study of the motivation of employees, and an appreciation of the fundamental importance of good communications between employer and employee, must both lead to a more efficient and a more contented farm labour force. Too many employers believe that good wages and working conditions, combined with adequate supervision, are all that is necessary. But most men, however humble or exalted their level of seniority, also seek status, a sense of achievement or satisfaction, to have pride in their work, recognition, to be appreciated, and many also want responsibility and prospects of advancement. Beyond a certain minimum acceptable wage level, these factors are probably of more importance than extra money to most men.

As to good communications, it is essential to appreciate that this is a two-way process. The manager's wishes should be accurately conveyed and fully understood by his employees, and if they are also accepted by them as being reasonable, the men will be more contented and therefore work better. They will be that much more acceptable if the employees know that their viewpoint has been considered, and that any recommendations and suggestions that they have made have been listened to and given consideration by the management. From the experience of his research work in hospitals, Professor Revans said at the Farm Management Association Conference at Harrogate last year: 'We find two interesting results. If the doctor listens to the nurse the patient gets better more quickly and the nurse herself is less likely to give up her job; if the doctor does not listen the patient suffers and the nurse leaves'. The parallel can be drawn in any industry, including farming, where the doctor is the farmer or manager, the nurse the worker, and the patients are the crops and livestock.

This article could not be concluded more appropriately than by another quotation from Professor Revans: 'Helpful as the accessories of technology are proving to be, your most precious assets are still and always will be the men who work for you. Your problem about making the best use of your human assets is to act as if you believe this'.

This article has been contributed by **J. S. Nix, M.A.(Cantab), B.Sc. (Econ).**, who is Farm Management Liaison Officer and Lecturer at Wye College (University of London). He was previously Senior Research Officer in the Farm Economics Branch of the School of Agriculture, Cambridge University.

Farm Accidents in 1967

There were 114 people killed on farms in England and Wales during 1967, one more than in 1966.

The main cause of death continued to be the overturning tractor, with 32 fatalities in 1967, as compared with 39 in 1966, and 36 in 1965.

It is particularly distressing that the figures include 23 children under 15 years of age. This is a steep rise compared with the figure of 17 in 1966, 16 in 1965, 18 in 1964 and 16 in each of the years 1963 and 1962.

Siring better beef by more precise selection of beef bulls is the aim of the Milk Marketing Board at their new stud, Warren Farm, which has recently been opened

Better Beef

S. R. O'Hanlon

A NEW chapter in genetic research has been opened at Warren Farm, the Milk Marketing Board's 1,182-acre farm near Lambourne on the Berkshire Downs. Its aim is the more precise selection of beef bulls for crossing on dairy cows, based on the relationship of performance and progeny testing. It is the first station of its kind in Britain and the most advanced in the world.

One-third of the Board's A.I. service comprises inseminations from beef bulls—over half a million a year—and it is the intention of the programme now being embarked upon to provide beef sires that are demonstrably well proven for fast growth-rate and superior beefing qualities. These growth recorded bulls will be test mated to a number of cows, then the progeny reared and fattened under identical conditions to obtain the most accurate measure of genetic differences, completing with slaughter and carcass analysis. The carcasses will disclose variations between the different progeny groups, so leading to investigations to determine whether these differences are heritable.

We also need, says the Board, to know the answers to questions about the selection of bulls for different systems of breeding and feeding for beef production. Dairy herds are now the great reservoir of beef production, and it does not necessarily follow that the ideal beef bull for cross-breeding on dairy cows will be the same as the ideal bull for 'pure' beef breeding. First tests are being confined to Hereford bulls and their progeny out of Friesian cows. Aberdeen Angus x Friesian may be tested later, and the trend in Charolais inseminations will also be scrutinized for long-term planning.

The calves

A specially designed nursery, complete with isolation unit, its own feed store and preparation rooms, caters for 220 calves, and there are six fattening yards which will accommodate 660 animals, allowing trough space of 2 ft per head. The calves are fed on glucose and warm water for the first two days, milk and glucose for the next two or three days, and then put on to full milk powder, calf nuts *ad lib.* and good hay. They are weaned at six weeks and fed *ad lib.* concentrates and hay. At twelve weeks feeding is gradually changed to a rolled barley and protein supplement and the calves moved into the fattening unit.

Fattening yards for 660 animals at Warren Farm

The carcasses

Peter Skelton, of Walls (who are evaluating the progeny carcasses) said that although there is at present no knowledge of the carcass variations which may be produced by different bulls within any one breed, there is already ample evidence of the differences which exist between breeds within the bovine species as we know it, and it is reasonable to think that these differences will also be apparent within breeds.

Carcass analyses carried out on Charolais x Friesian and Hereford x Friesian in the course of the Ministry of Agriculture's Charolais trials showed considerable variation, both in the content of lean meat and the yield of prime cuts. An increase of a mere 1 per cent in saleable meat may not at first glance seem an exciting figure, but on a 580 lb carcass it would mean that 1,000 tons of meat could be produced by only 5,995 cattle instead of 6,090 and the commercial return to both farmer and butcher very well worth while.

Complete results of the progeny tests from the first team of seventeen Hereford bulls will be available in May. Stocks of semen have already been built up, so enabling farmers to order inseminations from the Milk Marketing Board as soon as the figures are known.

Agricultural Machinery

39th International Exhibition 5–10th March, 1968

This exhibition, which is being held in Paris, offers British agriculturists facilities for making personal contacts with their European colleagues. Enquiries to Salon International de la Machine Agricule, 95, Rue Saint-Lazare, Paris (9°).

Break Crops

Grain Maize

R. E. Gunn

THE history of maize in Britain goes back to the time of William Cobbett who, having seen the crop in America, suggested that it should be grown for grain in this country. In spite of Cobbett's enthusiasm, however, maize has never found a permanent place in British agriculture. Its failure to do so is attributable firstly to the lack of early and productive varieties and secondly to inadequate knowledge of the most appropriate techniques for cultivation and harvesting. Over the past few years much information has been accumulated on the agronomy and harvesting of this crop and a position has now been reached which allows an evaluation of the methods and cost of production.

It has been estimated that some 400–450 acres of maize for grain were grown in England in 1967. This is the highest acreage for some years. It seems unlikely at the present stage of development that the acreage will or should expand markedly in the near future, for while present hybrids can and have given good crops in good seasons, there are still many uncertainties about the consistency of the level of yield, the difficulties of harvesting in late seasons and the high costs of drying. From the results obtained so far it is clear that the primary need is for new hybrids which will combine early enough ripening with a high productivity. Early ripening is essential if consistent yields are to be obtained from year to year and the requirement for low moisture content met. Thus the long-term future of maize as a grain crop in Britain will depend on whether the plant breeder can fulfil these objectives from the genetic material available to him. To this end work is now being carried out by the A.R.C. Unit of Experimental Agronomy at Oxford and by Dr. Pap of Messrs. Hurst, Gunson, Cooper Taber Ltd. at Kelvedon.

Choice of locality

Not all areas of England are suitable for maize production. The northern limit is commonly accepted as being in a line from Bristol to the Wash. Some N.A.A.S. officers prefer to exclude the south-western part of the country from the recommended area. Within this area the suitability of land for

Maize ears as seen during growth

maize is determined by local conditions. Thus exposed sites or shallow or drought prone soils are unsuitable even in the far south. Heavy clay soils must be precluded since they are slow to warm up in the spring. The best sites combine a south-facing slope with shelter from the north and east and a soil which is a medium loam.

Cultivations, sowing and establishment

Preparation of the seedbed for maize is essentially similar to that for a root break crop, namely a requirement of deep cultivations in the winter. But in the spring cultivation should be kept to a minimum to conserve soil moisture and to ensure even emergence. The most appropriate rates of fertilizer application will vary with locality and the previous cropping history of the land. Trials have shown that the greatest response is to nitrogen. Applications within the range of 80–150 units of N per acre have given the most satisfactory results. The fertilizer may be incorporated during the preparation of the seedbed or as a top-dressing up to five weeks after sowing. It is important that the fertilizer should not be applied by a combine drill as maize seed is very susceptible to a high 'salt' concentration. Experiments in the United States and on the Continent have indicated that band placement of the fertilizer may result in higher grain yields but no comparable data for this country are as yet available. Experience has shown that there is no practical advantage in sowing maize before the latter half of April. It is rare for maize to emerge before the end of April no matter how early it is sown, and early-sown seed is prone to attack by soil-borne pathogens which may cause serious loss of stand. This loss of stand may be offset to some extent by the use of fungicidal seed dressings, but experiments indicate that even in a favourable year, crops sown before mid-April do not yield more grain than those sown towards the end of the month.

For the most suitable hybrids which are at present available a stand of 30–35 thousand plants per acre has been found to give the highest grain yields. The amount of seed sown to achieve such stands varies from one variety to another, since these differ in seed size, but is of the order of 35 lb per acre. It is evident that the disappointing yields that have been obtained

in some recent crops has largely been due to too low a sowing rate. Maize is tolerant of a wide range of row widths up to 30 in., provided that the total plant population per acre is held constant. With rows wider than 30 in. yields begin to fall off. At present row width is governed mainly by the requirements of harvesting machinery which cannot cope with rows set closer than 27 in. A planting depth of 2 in. has been found to be adequate for British conditions. Ordinary grain drills are not entirely satisfactory for sowing maize since they do not always distribute the seed evenly. The seed is best sown by precision drill of the type commonly used for peas and beans. It is important that a belt suitable for maize seed is used on such implements or gaps may appear in the rows due to blockages. This is particularly important where the seed used has not been graded for size.

Weeds, pests and other hazards

Weed control in maize has been greatly facilitated by the development of the triazine herbicides. Of these atrazine is preferred to simazine since it is more soluble in water. These herbicides control most broad-leaved annuals and annual grasses for which an application of 1–1·5 lb of active compound per acre is generally sufficient whether it is applied as a pre-emergence or post-emergence spray. Pre-emergence applications of atrazine at 4 lb of active compound per acre have been used successfully for the control of couch grass in maize. Atrazine is not, however, effective against deep-rooted perennial weeds such as bindweed, redshank and creeping thistle for which treatment with a 'hormone' weed-killer may be necessary.

Of the major pests rooks are probably the most important. Some growers have reported losses by rooks feeding on newly-sown maize and have found it necessary to make sure that no seed is left on the surface after sowing. Most of the trouble, however, appears to arise during and just after emergence when rooks will pull up the young seedlings. Control measures based on the chemical treatment of the seed have so far proved unsuccessful in this country. At present it would seem that the most effective measures are the suspension of cotton thread over the crop at about 10-yd intervals and dawn patrolling during the critical period of three weeks for establishment. The severity of attack by rooks depends on the acreage of maize grown and on alternative food supplies. Where maize is grown on a large scale it is unlikely that rooks would cause significant crop losses.

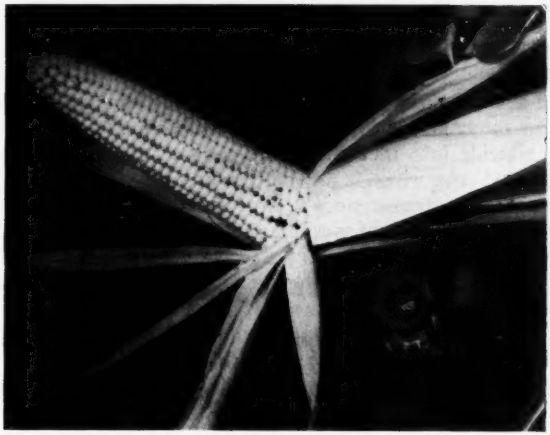
Some maize crops have been damaged by frit fly but this can be prevented by the application of 'phorate' granules to the seedbed at 1·5 lb active compound per acre. Attacks by this pest are in any case sporadic and there is no convincing evidence that they affect grain yield to a serious extent.

Late spring frosts may check the growth of maize in some areas but the growing point is well protected at this stage so that the crop recovers, although it may mature a little later than normal.

Harvesting and storage

Current maize hybrids are usually ready for harvest towards the end of October or in early November. The various methods for the mechanical harvesting of maize are shown in the Table on p. 70. Messrs. J. Mann and Son Ltd., of Saxham have successfully demonstrated the use of the Claas Matador combine harvester with maize pick-up attachment on crops grown

in the South-East during the past two seasons. Dr. Milbourn and his colleagues at Wye College have obtained satisfactory results with the Rivierre-Casalis cob picker. At present the advantage would appear to lie with the



Maize ears in the final stage of growth

modified combine harvester since this machine shells the grain as well as cutting and dispersing the stover. Also most of the farmers who are likely to be interested in growing grain maize will already possess a combine harvester and the cost of the necessary modifications is relatively small compared with the cost of a cob picker.

At present the storage of grain is a very considerable problem for the grain of today's hybrids is of high moisture content at harvest. Moisture contents of the order of 35–45 per cent are common with crops grown in central and south-eastern England but may be lower in the far south. Crib storage of whole ears is practicable only when the moisture content is below 35 per cent. At higher levels the width of crib necessary to ensure satisfactory drying is so small as to be uneconomic on a large scale. Maize grain has been stored successfully in sealed silos but difficulties arise when the silo is opened. After opening, the grain must be used within a few days or moulds will cause rapid deterioration in quality. Until these problems have been solved it will be necessary to dry the grain artificially before storage. Most growers have found it necessary to carry out this operation in two stages with an interval to allow moisture to diffuse out from the centre of the kernels. Drying costs have been estimated in the region of 50–60 shillings per ton for a crop harvested at a moisture content of 40 per cent.

The place in the rotation

There can be little doubt that the potentiality of maize as a grain crop in this country will depend upon its value as a break crop in intensive cereal production. The value of a break crop depends on three groups of factors: the degree of control it gives over the build-up of cereal diseases, the opportunity it affords for weed control and the net return per acre derived from the break crop itself.

Maize is not infected by the cereal diseases eyespot, yellow rust and rhyncosporium leaf blotch, all of which are of increasing importance in the South-East. Recent studies have shown that it is more resistant to take-all than barley but less so than oats.

Maize has a special value in its resistance to high doses of atrazine. This is of particular interest because couch grass is one of the major problems facing cereal growers in this country. The control of couch grass is important not only because of the detrimental effect of the weed itself but also because it acts as a host for the take-all fungus. The high doses of atrazine necessary for the control of couch grass may result in a significant carry-over of the herbicide into the succeeding season, thus necessitating the growing of a second crop which is resistant to atrazine. This cannot be wholly considered as a disadvantage since a two-year break is in any case necessary for the adequate control of eyespot, and there is the further gain in that the need for weed control measures in the second year will be less. The second year break might well be maize: the possibilities of alternative crops are still being explored, for example, beans which show some resistance to atrazine.

It is difficult to make an accurate assessment of the net return per acre to be expected from maize since this crop has never been grown on a large scale here. It must also be emphasized that the existing hybrids which are being used, because they ripen late, may have a potentially higher capacity for yield than the earlier types which will be required on other grounds. Results from small scale replicated trials and from the few commercial crops that have been grown so far, indicate that grain yields of the order of 35–40 cwt per acre are commonly obtainable in the northern half of the recommended region rising to 45–50 cwt per acre in the far south. Since maize is not a subsidized cereal crop in Britain the price paid to the farmer is governed by the condition of the world market; at present it is around £24 per ton. Estimates of the variable costs involved in maize production have been made on crops grown at Wye and in the Isle of Wight (see *Agriculture* Vol. 73, January, 1966, p. 32 and Vol. 74, June, 1967, p. 285) and average around £18–19 per acre exclusive of drying costs. Thus when drying costs have been taken into consideration a crop yielding 2 tons of grain per acre could be expected to give a gross margin in the region of £23–25 per acre.

Table

Methods of harvesting grain maize

Harvesting machinery		Capacity (acres/day)	Treatment of ears	Treatment of stover	Remarks
*Combine harvester with pick-up attachment	2 row 3 row	4—6 7—8	shelled immediately	cut and dispersed	Cheapest method. Heavy wear on machinery and grain may be slightly damaged.
*Combine harvester with cob picking attachment	2 row 3 row	6—7 10—13	shelled immediately	left standing	Handles grain gently. Less wear on machinery than with pick-up attachment.
Cob picker	1 row	3—5	husked but not shelled	left standing	Machinery suitable only for harvesting maize.
Cob picker/sheller	1 row	2—4	shelled immediately	left standing	

*Combine harvesters used for maize require a special drum and concave. These can be fitted on the farm.

This article has been contributed by **R. E. Gunn, B.Sc. (Hons.), (Agric. Botany)**, who is a Senior Scientific Officer (Maize Breeder) at the Agricultural Research Council Unit of Experimental Agronomy, Department of Agriculture, Oxford University.

The author discusses the ever-increasing role that herbicides are taking in sugar beet production in Britain today

Herbicides in Sugar Beet Production

W. E. Bray

OVER the past ten years advances in seed material, husbandry techniques and mechanical and technical aids have affected the growing of the sugar beet crop in Britain to a very marked degree. So much so that many growers and research workers are thinking that in the not too distant future a large proportion of the crop could be grown without any attention between sowing and harvest. To be thinking in these terms when not long ago a thick seeding had to be hand-thinned, singled and weeded, mechanically hoed between the rows, and then lifted by hand indicates the rapid advances in production methods that have been achieved in a very short time.

Any system which reduces to a minimum hand and mechanical operations between sowing and harvest relies heavily on there being available a reliable system of chemical weed control, in order that the beet develop in an environment free from competition.

The present situation

In 1961, only ten per cent of the total British sugar beet acreage was treated with herbicides but by 1967 this proportion had risen to around seventy per cent. Before 1961, there were two factors which kept herbicide usage in the beet crop low. Firstly, difficulty was experienced in chemical research establishments in finding a chemical that would give selective control of a wide range of annual weeds, including such species as fat hen (*Chenopodium album*) and orache (*Atriplex patula*) which are of the same botanical family as sugar beet; and secondly, the shortage of labour for hand and mechanical work was generally only just becoming critical. Since 1961, several herbicides with the required selectivity have been discovered and, with the farm labour force rapidly diminishing, these new products have been increasingly utilized.

The chemical weed-killers available at present can be conveniently considered by classifying them into four groups according to when they are applied in relation to sowing and emergence of the crop: before drilling, at or immediately after drilling, just before crop emergence, and after crop emergence.

A classified list of herbicides available in 1968 for weed control in sugar beet is shown in the following table:

Herbicides available for use in sugar beet in 1968

Application time:

Before sowing	At sowing	Just before crop emergence	After emergence
Type of action:			
residual	*residual*	*contact + residual*	*contact*	*mainly contact*
di-allate*	chlorpropham + thiuron	dimexan + chlorbufam + cycluron*	cresylic acids	barban*
propham*	lenacil*		dimexan*	common salt
TCA*	propham		paraquat*	dalapon*
	propham + chlorpropham + fenuron*		paraquat + diquat*	nitrate of soda
	propham + diuron		PCP*	phenmediphamt
	propham + endothal*			pyrazon + wetter
	propham + endothal + medinoterb			
	propham + medinoterb			
	pyrazon*			

*Approved under the Agricultural Chemicals Approval Scheme.

†This product is expected to be available for 1968 sowings.

At present, the most popular weed-killers are those that are residual in action, that is, they are applied to the soil and control the weeds before or soon after they emerge. They remain active in the soil for some time, their persistence depending on the inherent properties of the chemical or chemicals, soil type, soil condition and weather occurring after application. Those recommended for application before sowing are mainly for the control of wild oats (*Avena fatua*) and, as there is a danger of loss of chemical due to volatilization, all three herbicides in this group should be incorporated into the soil immediately after application. In addition to controlling wild oats, propham will control a limited range of broad-leaved weeds which include such important species as annual nettle (*Urtica urens*), chickweed (*Stellaria media*), spurrey (*Spergula arvensis*), black bindweed, knotgrass and redshank (*Polygonum convolvulus*, *P. aviculare* and *P. persicaria*).

Propham was one of the first selective chemicals widely used for weed control in sugar beet and, as it controls some of the major weeds found in the beet fields, and is cheap and relatively safe, it has formed a basis for many of the herbicide mixtures available today (see table). The range of weeds controlled by each of these mixtures, and by the other residual materials listed to be applied at the time of sowing, varies to some extent. Therefore, when choosing between these products, individual weed species that are resistant to them must be taken into account. In addition, the

activity of these herbicides is affected by variations in soil type. Increases in heaviness or organic matter content of the soil reduce the effect of the chemical, with the result that most of these products are not recommended for the entire range of soils upon which beet are grown in this country. However, the nine herbicides of this type available do provide the farmer with a choice to cover most weed and soil situations.

The weed-killers with only contact action, i.e., those which act on emerging or emerged plants non-selectively and have little or no residual activity, are not so widely used in beet as they are in some other arable crops. This is because they suffer from three disadvantages which most beet growers are not prepared to risk. For efficient control the majority of weeds must be emerged at the time of application, which by necessity is before beet emergence, and unfortunately this condition rarely occurs in practice; it is difficult to judge when the beet are likely to emerge; and adverse weather can delay spraying with the result that the crop comes up and the opportunity for chemical weed control is gone.

Up to now the herbicides that have been available for post-emergence application have only been used in cases of emergency, because their effects on crop and weeds could often be erratic. Their activity is severely affected by small variations in weather conditions and by the stages of growth of both beet and weeds.

The immediate future

The present position with regard to residual herbicide usage has been achieved very quickly and there are several improvements that are necessary before chemical weed control in the beet crop is entirely satisfactory. There is a need for:

1. the weed-killers to be less costly,
2. greater safety of the crop under adverse weather conditions,
3. control of late germinating weeds, that look untidy and often hinder harvesting operations, by the use of herbicides with longer persistence, or the use of suitable materials applied both before and after emergence of the crop,
4. a simpler application method that minimizes the effect of inaccurate calibration and spraying and, if possible, allows the speed of drills to be increased in order that sowing can be completed as early as possible in the spring.

A large proportion of the work on weed control in sugar beet at the Norfolk Agricultural Station and elsewhere is being devoted to these problems.

Cost and crop safety

There are only two possibilities open to scientists and agriculturists to reduce the present costs of chemical weed control in the sugar beet crop. Firstly, an entirely new compound or mixture could be discovered, the production of which makes it cheaper than herbicides listed in the table. Alternatively, an established herbicide could be mixed with a cheaper new or old product and, so long as selectivity and weed control were not impaired, a less costly material would be available to beet growers.

These two methods could also be used to produce safer weed-killers, but in addition greater knowledge of the mode of action of herbicides under different application, soil and weather conditions would greatly help research workers.

Increased safety and lower cost would in themselves markedly widen the demand for overall application but there are many growers who feel that mechanical disturbance of the soil between the rows of beet is beneficial to the crop. To examine this problem several investigations have been conducted in Britain and Europe to assess the effects of 'minimum cultivations' on the best crop. The results from trials at the Norfolk Agricultural Station have been similar to those obtained on the Continent. These indicate that the absence of inter-row hoeing is not detrimental to the crop and in fact could be advantageous as there is strong evidence that soil disturbance encourages weed seeds to germinate. Further work is needed on this problem of 'minimum cultivations', particularly on soils that are prone to 'capping'.

Persistence

To discover a new herbicide with long enough persistence to control weeds emerging between singling and the time when the crop can satisfactorily suppress emerging weeds could prove difficult as there is a tendency for really persistent chemicals to be toxic to sugar beet. To overcome this problem for the immediate future, it may be necessary to use a residual pre-emergence herbicide followed by a contact post-emergence one. Up to now this technique has not been really practicable owing to the high cost of two materials, the cost of their application and the rather unpredictable results expected with the post-emergence products so far available. If phenmedipham is available for the 1968 sugar-beet season, a 'two-herbicide' system would then be a possibility. This chemical, developed in West Germany, has been under investigation in Britain for the past two years and has been found to be a very selective contact material best suited for post-emergence use. Initially, cost is likely to limit the widespread use of a system of this sort but further investigations into the success of reduced doses of the available residual pre-emergence applied herbicides, followed by effective post-emergence chemicals, could help overcome this problem.

Application methods

Whilst the costs of herbicides for use in sugar beet remain high, it is likely that a large proportion of them will be applied in a restricted band over the drilled row, leaving the inter-row space to be weeded mechanically or by cheaper chemical methods. The calibration and operation of a band-sprayer is a complicated procedure and, if it is attached to the drill, sowing speed is not only restricted but the responsibilities of the tractor driver are at an extremely high level. Even if the costs of the chemicals were reduced and there was a move towards overall application, it could be just as tricky as band-spraying is at present, unless the materials had a wider crop safety margin, although one advantage would be that drilling and herbicide application would become separate operations.

The introduction in 1967 of a granular herbicide (chlorpropham + thiuron) has opened up a new field of application techniques. It is applied by the type of machine used quite widely for granular insecticides and calibration and operation generally has been found to be quite simple and accurate. Power is obtained through a drive from a land-wheel so that variations in forward speeds are compensated by equivalent variations in

rates of application. Slight modifications to this new system are possibly necessary but it is to be hoped that other granular herbicides will be introduced for use in sugar beet and, if they are as efficient as the sprays now in use, then the difficulties of herbicide application can be expected to be largely reduced.

The future

It is obvious that although great advances have recently been made in techniques for chemical weed control in sugar beet there are still several improvements that are necessary before herbicide usage is entirely satisfactory in this important arable crop. However, the advances that have been made have led many progressive growers to think in terms of growing beet with no thinning, singling, or mechanical cultivations, not just in the foreseeable future, but at the present time. This will not be widely practicable for some time yet but within the next decade weed control in the sugar beet crop could be one of the lesser problems confronting the grower.

This article has been contributed by **W. E. Bray, B.Sc. (Hons.) Agric.,** who is Trials Officer responsible for weed-control work in sugar beet at the Norfolk Agricultural Station, Sprowston, Norwich. Previous to taking up this appointment he was engaged as a research agriculturist with an independent consultant working on all types of chemicals for agriculture and horticulture.

The Ministry's Publications

Since the list published in the January, 1968, issue of *Agriculture* (p. 33) the following publications have been issued:

MAJOR PUBLICATIONS

Bulletin No. 5. Fruit Spraying Machines (New) 6*s.* (by post 6*s.* 6*d.*)

Bulletin No. 174. Poultry Nutrition (New) 8*s.* 6*d.* (by post 9*s.* 1*d.*)

Mechanization Leaflet No. 6. Bulk Grain Driers (Revised) 1*s.* 6*d.* (by post 1*s.* 9*d.*)

Mechanization Leaflet No. 16. Bale Handling Equipment and Systems (New) 1*s.* (by post 1*s.* 3*d.*)

FREE ISSUES

ADVISORY LEAFLETS

No. 18. Cabbage Root Fly (Revised)

No. 115. Slugs and Snails (Revised)

No. 176. Currant and Gooseberry Aphids (Revised)

No. 321. Eyespot and Sharp Eyespot of Wheat and Barley (Revised)

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Cheddar Strawberries

The New Look

A. A. Tompsett

CHEDDAR, well known for its strawberries, is rapidly and confidently intensifying its production under cloches, to supply the early dessert fruit market. Compared with only five years ago these hillsides with their acres of glass and polythene coverage present a new and eye-catching feature in the green Somerset landscape. This area of specialized growers was described by the author in *Agriculture* Vol. 70, No. 11 (November, 1963) and this article aims at describing the recent developments which have taken place there, with forms of protected growing.

Acreage unchanged

While the total area of strawberries in this district remains fairly constant at about 300 acres, the proportion of the crop grown with some form of coverage is estimated at 20 per cent, and on several holdings the outdoor crop is now of secondary importance. The reason for the swing to earlier production is basically economic, but has been accelerated by social and managerial factors, and it is proposed to consider these briefly before turning to the cultural aspects of the crop.

The holdings are mainly small family concerns with almost complete financial dependence upon the strawberry crop. An average holding consists of three to four acres of strawberries, this being tended by the grower and his family for the major part of the year. Regular labour is not usually employed because of the slack winter period and employed casual labour in quantity is only sought for strawing and picking. Early land is scarce and expensive—prices often rising above £1,000 per acre. To meet increasing costs, and the desire for a rising standard of living, growers are aiming to increase their output from existing land and labour resources.

An important feature of the price returns received by the growers in 1966, after the deduction of marketing charges and transport, is the rapid fall in prices at the point when the outdoor season begins, and these low prices

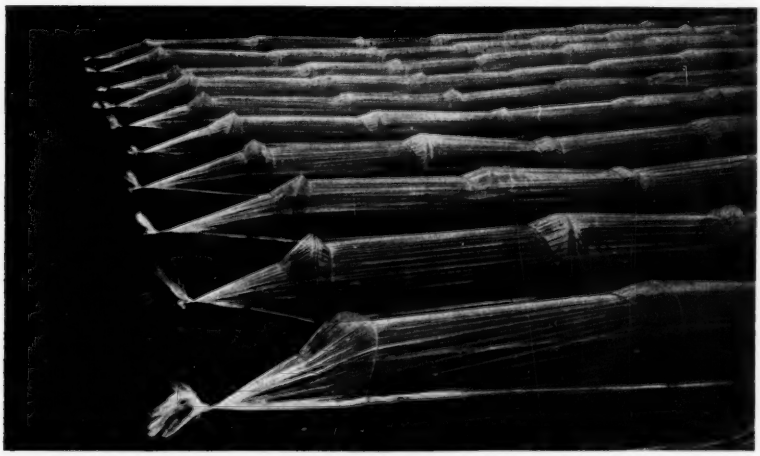
reached about the middle of June tend to persist to the end of the season, when there may be a slight upward trend. Any means of advancing the harvesting period will normally increase average prices per pound considerably and raise the overall holding income for the same area of crop.

Picking problem

The second major cause of the swing towards the earlier, more intensive production is the local shortage of experienced picking labour. Fewer women are now available to undertake fruit picking work and there is increasing competition for the diminishing pool of good casual labour. The harvesting period for strawberries at Cheddar, which used to be no more than 4–5 weeks, now, by the use of cloches, extends over 8–9 weeks, thereby greatly increasing the proportion of the crop that the grower with his family and small picking gang can effectively gather. In this way a longer harvesting period has considerably relieved the problem of picking, therefore, employed picking labour may actually be reduced and the problems of a large picking gang with its organization and transport difficulties lessened. Some growers have reduced their area of strawberries to concentrate on the more valuable protected crop, although the majority are producing strawberries over a long season with glass, polythene and outdoor crops, ripening in succession.

There is little comparative information on the relative profitability of the various types of coverage and much depends upon the skill and understanding with which they are used. As a result of experience gained in recent years, it is not unusual to find several types of coverage, especially plastics, side by side on the same holding. This not only spreads the fruiting period, and the risks, but also means that within the single crop there have developed several different growing techniques each suited to a particular site, soil or variety. Of course, availability of capital affects the choice between glass and polythene coverage, the former costing up to £2,700 per acre while polythene varies from £200 to £500 per acre, according to the system used. Gross returns vary considerably, but may be in the order of £2,000 or more per acre for

Polythene tunnels showing ends securely tied



Glass cloches of the growers' barn type covering strawberries

glass cloches and £1,200 to £1,500 for polythene, although with the latter there are still considerable risk factors particularly from wind.

Culture and types of coverage

The main varieties in order of importance for covering are Cambridge Vigour, Redgauntlet and Cambridge Favourite. Planting is done in August and early September with spacings between plants starting at 9–12 in. apart and decreasing to 6–8 in. for the latest plantings. While early planting produces a large, leafy plant with a tendency to late ripening, the later plantings will produce an early but very light crop unless the spacing is sufficiently close. Finding the correct compromise of spacing and planting date for each site is very important, especially now that with planting machines and irrigation, planting can go ahead according to plan and is less dependent upon weather and labour than it used to be.

The planting plan depends upon the type of coverage to be used. For glass barn type cloches, rows are planted alternately at 2 ft and 4 ft apart, while for polythene, arrangements vary from single rows under narrow tunnels or twin staggered rows under wider covers. More recently the use of polythene laid flat over a pair of rows at normal spacings of 27–30 in. has become popular, and sometimes a proportion of two-year-old plantations are treated in this way.

Cloches are placed over the crops in February and early March and there appears to be no advantage in covering earlier. In fact, early covering brings its dangers of snow damage to glass cloches and increased wind risk with plastics. Several types of glass cloches are used, but the growers barn type with removable roof panel is preferred. This gives more room inside the cloche than the tent type and with the roof glass removed spraying and picking are possible without handling the cloches.

Many types of polythene coverage are in use and each type has its adherents. Apart from initial cost, ease of erection, ease of opening for cultural operations and picking, and ability to withstand wind are major factors. Although polythene covered crops are usually seven days later in ripening than those under glass, the ease of opening and safety with pickers makes them popular, particularly with the larger growers. The polythene tunnel employing wire hoops is widely used because of its low cost and simplicity, but serious losses from wind have occurred at times and many

growers are anchoring the hoops with wires or pegs or seaming cables into the edges of the polythene, these being pegged down at intervals along each side.

By far the simplest method of coverage yet devised consists of polythene laid directly over the plants. The edges of the polythene have wires seamed inside and these are pegged down and moved inwards as the plants grow to allow more slack polythene over the plants. The system withstands wind, although the plants themselves may be severely buffeted if the site is too exposed. The system can be very early but yields and quality can be poor unless care is taken to avoid excessively high temperatures under the film. This problem is being met by either progressively propping up the side wires. or removing the film completely at fruit swelling.

Autumn cropping

An increasing area of the variety Redgauntlet is being grown under cloches for autumn fruiting. This variety is well known for its ability to fruit twice in one year, but unless both the spring and autumn crops are covered, the autumn fruit will normally ripen too late. As Vigour is preferred for spring covering with glass, it is usual for the Redgauntlet to be covered with polythene in spring. The glass cloches are then moved across on to the Redgauntlet in August to protect the fruit which ripens during September and October. After this the glass is stacked ready for re-use the following February. Apart from this secondary use of the glass cloches, no attempt is being made to use them for other crops, mainly because of the high labour requirement inherent in traditional cloche systems.

Fears for early prices

Although the district has a recognizable sense of optimism and an aura of success, there are some fears about the downward trend in early strawberry prices which could undermine the current trend towards earlier production. However, while it is expected that the demand for the earliest, most highly-priced fruit could be easily satisfied, the prospects appear more favourable for increased production in the middle-priced period when demand has been created, the weather may have improved and prices to the consumer are more reasonable.

It is possible that there will be a further swing towards the simpler forms of plastic coverage which lend themselves to larger scale growing and mechanized handling. Already some progress is being made in this direction and, as in any intensive and specialized area, Cheddar growers will readily apply new and improved methods to meet changing situations.

The author of this article, **A. A. Tompsett, N.D.H.,** is a Horticultural Adviser in the N.A.A.S. and since 1962 has been in that part of Somerset in which Cheddar is situated. He was previously at Luddington Experimental Horticulture Station, where he was concerned with trials which included soft fruit and weed control. Mr. Tompsett's recent move to the Maidstone area of Kent has given him an opportunity to take a special interest in fruit crops.

Fruit Tree Replant Disease

Brian M. Savory

To my mind, the most striking feature of replant disease is that the fruit grower may not realize that his trees are suffering from it. This is due largely to the fact that there are no leaf symptoms, and of course the grower cannot easily inspect the roots of his trees! In mild cases of the disease, only comparison with healthy trees of the same age and variety can reveal the extent of the reduction in growth. In severe cases, however, replant disease can scarcely be overlooked, as some cherry growers can testify.

The problem of replant disease in cherry orchards has, in fact, been recognized for a very long time. It is only recently, however, with the adoption of more intensive methods of orchard management, and increasing amounts of grubbing and replanting, that the importance of the problem in apples has been realized in this country. In the Netherlands, apple replant disease has been considered a serious problem for some years.

Nature of the disease

For practical purposes, we can take it that, of British fruit crops, only apples and cherries are affected by replant disease. The effects are seen when an orchard or nursery is replanted, with apples following apples or pears, or cherries following cherries or plums. Where cherries are planted after apples (or *vice versa*) no replant disease occurs. The causal agents of replant disease are still unknown, but they are clearly *specific*, and affect only replants that follow a closely related crop.

Experiments at East Malling, some of which are still in progress, have shown that some apple and cherry scion varieties, and some apple rootstocks, are less affected than others by replant disease; but no completely resistant variety has yet been discovered.

Affected replants appear to make normal growth in the spring after planting. However, the roots are not developing normally. The main roots are weak, and may die in the early summer. Lateral roots are few and short, and often die prematurely. Shoot growth is therefore bound to be affected before long. In fact, rootstocks lined out in the nursery will often stop shoot growth by the end of June, and maiden trees by July-August. By the end of the normal growing season, therefore (September for cherries, October for most apples), a diseased replant will have made only 25–50 per cent of the growth of a normal, healthy plant of that variety. Cherry replants have been known not to make any shoot growth at all in the first year, but such

severe effects rarely, if ever, occur in apples. In the second year after planting, growth is more normal in most cases, but the number of branches is very much reduced, and the affected replant never really catches up with a normal, healthy tree.

Crops are reduced

Apple growers are accustomed to make use of dwarfing rootstocks, to produce a small but fruitful tree. They have often asked me, therefore, whether replant disease is really such a serious matter. They have suggested that an affected replant on a vigorous rootstock may merely be reduced in size, to produce a small, fruitful tree similar to a healthy one on a dwarfing stock. The short answer to this is that replant disease just does not work this way—unfortunately!

Affected replants, being stunted and lacking in vigour, produce less fruiting spurs and less fruit per tree than healthy trees of the same type. Moreover, it is definitely not safe to plant more trees per acre than would normally be recommended for the variety and rootstock concerned, because the replants will eventually (though belatedly) reach the same size as healthy trees. Reducing the planting spacing will therefore result in eventual overcrowding, and even greater loss of crop. One cannot escape the fact that, where it is present, replant disease will cause serious economic losses to the fruit grower or nurseryman, if steps are not taken to control or avoid it. If replant disease is present on an orchard or nursery site, the easiest way out is to replant elsewhere on fresh land, if this is feasible, or to plant a different crop. This, however, is often impracticable. Replant disease persists for long periods in the soil, for at least eight years or even more. It is therefore impossible to avoid it by devoting the land to arable crops for a few years between fruit crops.

Control measures

Tests carried out at East Malling and by N.A.A.S. pathologists have shown that fairly severe replant disease is present in a little over one in every three of the 150 apple orchard sites sampled so far. So little cherry replanting is being done that there are no comparable figures for cherry land. The chances that replant disease is present in a soil are much greater in alkaline or near-neutral soils; it seems to occur much more rarely in acid soils.

If a grower is faced with the need to replant apples after apples, he would be wise to ask the N.A.A.S. pathologists to test the soil for replant disease. Where normal autumn planting is intended, soil test samples should be taken by the preceding March at the latest. Results of the test will be available in August, allowing time for control measures to be carried out before planting.

The only satisfactory method of control at present is to fumigate the soil with chloropicrin. None of the other soil fumigants tested at East Malling or in the Netherlands have proved successful, though one or two have sometimes improved the growth of replants to some extent.

Chloropicrin has been used for soil fumigation for many years, for the control of nursery diseases, and diseases of tomatoes and strawberries. In the last year or two, however, interest has grown in using it to control replant disease, and this has led to its clearance this year under the Ministry's Pesticide Safety Precautions Scheme. As it is a tear gas, it is not a pleasant

Cox's Orange Pippin on M26 planted Dec. 1966 on apple land. (Left) site untreated (Right) site fumigated before planting with chloropicrin at rate of 25 gal per acre

material to handle, and it is necessary to wear a gas mask (respirator) when the liquid is exposed to the air, allowing vapour to escape—for instance, while transferring the liquid to a soil injector.* Special machinery is also required to inject it into the soil, if more than a small area is to be treated. However, it is not necessary for a grower to undertake chloropicrin fumigation personally. At least one firm[1] now offers a contract service, by which several acres can be fumigated in a day by personnel trained to handle chloropicrin safely.

Preparing for fumigation

The causal agent of replant disease does not move through the soil. It exists only in those areas where the roots of the previous crop were present. It has also been found that, if replants are provided with sufficient fresh or fumigated soil in which to develop their roots during the first year, they will suffer no effects of replant disease in subsequent years—although by then their roots are exploring untreated soil. Therefore it is not necessary to fumigate the whole area of an orchard before replanting. Fumigation of a 6 × 6 ft square is adequate to secure healthy growth of cherry replants, while for apples a $4\frac{1}{2} \times 4\frac{1}{2}$ ft square is sufficient. Where the trees are to be planted at distances of less than about 15 feet apart in the rows, it is more economical to fumigate a $4\frac{1}{2}$ ft-wide strip for each row, thus enabling the fumigation to be done mechanically.

*The possibility is being considered of regulating chloropicrin as a Part I substance under the Agriculture (Poisonous Substances) Regulations. Any such regulation might exempt users from the requirement to wear protective clothing when injecting soil out-of-doors (but not indoors) with chloropicrin but would probably require full Part I protective clothing to be worn when opening a container or diluting, mixing or transferring the chemical from one container to another.

[1]*The Grower*, Sept. 2nd, 1967 (p. 385).

Trials at East Malling have shown that a rate of 25 gallons per acre of chloropicrin is adequate to control replant disease on loamy soils. Slightly higher dose-rates may prove beneficial on heavy clay soils. Thus, if the tree rows are to be spaced 13 ft apart, only one-third of the orchard area need be fumigated, and the amount of chloropicrin required is under 9 gallons per acre of orchard. This means that the cost of fumigation is reduced to an economic level. Naturally, if the tree rows are to be further apart, the cost of fumigation will be even further reduced. In nurseries, where plant rows are closely spaced, it will probably be necessary to fumigate all the land.

As growers in this country are unfamiliar with the technique of soil fumigation, I must stress that its success depends, to a considerable extent, on the thorough preparation of the soil beforehand. If the soil is cloddy, or contains much rotting grass or other plant debris, no fumigant can penetrate it satisfactorily, and results may be disappointing. Grassed-down orchards should be ploughed in the spring, after grubbing. The site will require a deep ploughing, to 10 in., 1–2 months before fumigation, and finally it should be disced or rotavated a day or two before fumigation, to provide a good, deep tilth. This last operation need only be done on the strips to be treated—which, of course, must by this time have been marked out.

When to fumigate

One of the advantages of chloropicrin is that it does not depend for its success on application under critically limited conditions. Midsummer application is inadvisable, because soils are then too dry, and fumigation in frozen soil is impossible. However, in most years, it is normally possible to fumigate satisfactorily with chloropicrin both in the spring (March–May) and in the autumn (late August–November). For orchard growers, the most convenient time is September–October, allowing December planting to be carried out in complete safety.

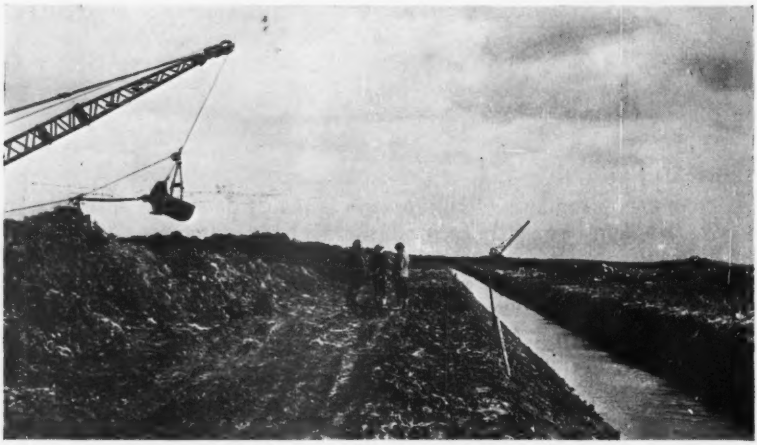
After the chloropicrin has been applied—by injection at a depth of 6 in.—it should be sealed in by rolling. Tine harrowing is an acceptable alternative on light, sandy soils. Covering with polyethylene sheets is not necessary with chloropicrin. About two weeks after fumigation, the soil should be turned over to release any remaining traces of the fumigant, and trees can be planted 2–4 weeks later, when no lingering smell of chloropicrin can be detected.

In conclusion, I feel that every apple and cherry grower and nurseryman should be aware of the existence of replant disease, and the serious crop reductions it can cause. He has nothing to fear, however, as long as he takes the precaution of getting his soil tested and, if necessary, fumigated, before replanting. It has been found in the Netherlands that, where severe replant disease is present, the cost of fumigation is more than repaid by the extra yield in the first two years of cropping: to reject fumigation because of the expense would indeed be a case of 'penny wise, pound foolish'.

This article has been contributed by **Brian M. Savory, M.A. (Oxon) Forestry, Ph.D. (Lond.) Horticulture,** who is head of the Plant Physiology and Herbicides Department, Plant Chemotherapy Division, May and Baker Ltd., Ongar, Essex. Previous to taking this appointment he was a Blackman Fellow in Pomology at East Malling, studying replant diseases.

Reclamation of Land from the Wash

C. F. Bycroft



'all are appropriate—bog, marsh and fen
are only poor to undiscerning men'
George Crabbe (18th Century)

THE Wash needs little introduction for history records important events such as the building of the Roman Bank from King's Lynn to Skegness as a defence against the sea, the loss of King John's treasure some 750 years ago and the Adventurers' extensive drainage and reclamation works 300 years ago. Since then the reclamations of land have been more modest in size but cumulatively important in winning many thousands of acres from the sea. Reclamation from the Wash is measured in centuries rather than decades for it takes about 100 years for a sufficient level of salt marsh to build up to make enclosure worth while. This building-up process is the result of the sea depositing minute particles of soil suspended in its waters and carried from other coastal areas into the backwaters of the deep indentation of the Wash. The ebb and flow of the tides, the currents of the Rivers Ouse, Nene, Welland and the Witham influence the extent to which deposits of soil are built up on the salt marshes. There appears to be a tendency for a speedier deposit between the outfall of the River Ouse and River Nene where 1,750 acres

have been reclaimed during the last 16 years. It is estimated that about 2,000 acres are ripe for enclosure between the River Nene and the River Welland.

The alluvial plain of 2,500 square miles stretching from King's Lynn on the east into the counties of Cambridge, Huntingdon and Peterborough and up to Bourne on the west and to Skegness in the north is criss-crossed by countless drainage systems and roads; those extending over the black peat fen near the borders of the high land must be considered engineers' delights with their straight lines and minimum obstructions. Between this fen and the shores of the Wash is an extensive curving ridge of alluvial silt built-up through the ages by the sea. In this area are the meandering roads and drainage systems which identify the various individual reclamations of land as they were carried out during the last 300 years.

It is not difficult to picture the tremendous efforts that must have been necessary to build the sea walls by hand, the desperate race against time and tide and the problems of dealing with deep creeks which meander across the salt marshes. These problems account for the twisting and turning of the sea walls when obstacles had to be avoided and the size and shape of enclosure was not important. Today there is no serious engineering problem to prevent the building of long and straight sea walls enclosing a maximum area of marsh land. In fact, it is essential on financial grounds to enclose as much land as possible.

Reclamation

Most of the foreshore below high water mark of medium tides is part of the Crown Estate but any natural accretion of land above that level which is gradual and imperceptible becomes the property of the owner of the adjoining land. Many years ago a number of Estuary Companies were formed to promote reclamation but these have ceased to function. One of them, the Norfolk Estuary Company, survived until quite recently when their rights reverted to the Crown. The Crown Estate Commissioners now administer much of the frontage land between the mouth of the Nene and Sandringham and it is in this area that most of the recent reclamations have been carried out.

The salt marshes are easily identified by the green herbage of grasses and marsh plants which extend almost to the water's edge. They were extensively grazed during the last century but labour scarcity and high costs make this uneconomic today. Reclamation should not be left beyond the time when the marshes are considered ripe for reclamation. Usually this stage is reached when the marsh level is about 10 feet above the Newlyn ordnance datum level of sea when an adequate depth of top soil with a correct mixture of loam and sand has been built-up. However, some imperfections of soil quality have to be accepted as the sea does not deposit even layers of silt. The embankments are built about 200 yards from the outer edge of the green salt marsh which may be a distance of 800 yards to 1,500 yards beyond the existing sea walls.

Most of the sea walls are privately owned but are subject to the control of the River Authorities which are responsible for maintenance and improvement. The cost of building new sea walls and ancillary works has to be borne by the reclaimers, but the River Authorities will take over future responsibility after an agreed time and subject to a strict specification of

Green saltmarsh ripe for reclamation. Boat creek in foreground—sea wall on right

construction. In practice, the River or Drainage Authorities may be prepared to undertake for a fee the whole of the preparatory work and supervision of a reclamation scheme which ensures a smooth take-over at a later date. Competitive tenders are obtained and it is the contractors' responsibility to carry out the work at the most suitable time. This is at a period of low tides when either a small cradge bank is quickly thrown up beyond the line of the new sea wall to keep the sea in check during the main construction; or if this is not possible the sea wall is extended without protection. Draglines dig out the marsh soil on the seaward side creating elongated borrow pits and place it on a broad foundation, previously levelled by bulldozing the top soil to one side; the lower part of the bank is built and consolidated. As the height increases the seaward side is graded typically to a slope of 1 in 4 whilst the landward side has a steeper slope of 1 in 2. The overall height of the bank depends on the level of the tide, against which protection is to be given. The recognized height of sea walls around the Wash is 22 O.D.N. and the highest known tide of 17 ft 9 in. O.D.N. occurred a few years ago when fortunately calm weather conditions prevented wave damage and sea invasion.

In addition to the building of sea walls, all watercourses have to be either embanked or controlled by sluice gates at their outfall into the Wash. A soak dyke along the foot of the sea wall on its landward side keeps the foundations of the wall drained and this ensures its stability. Erosion on the seaward side is checked by stones placed along the toe of the bank and general erosion is prevented by growing grass. Access to the reclaimed area has to be provided and hardcore roads are built today instead of the former grassed earth tracks which would not stand up to the wear and tear of modern machinery.

Cropping and costs

It is at this stage that the farmer takes over and he must have patience, determination and a dedicated interest in the project to achieve results to justify the whole enterprise. Patience is required during the period in which the marsh loses its salinity. This can vary according to the type of soil and speed with which the water table is lowered. Drainage ditches have to be dug at frequent intervals to allow a free flow of water and shallow and irregular

creeks blocked-off for filling. Care has to be taken not to damage the soil structure before it has been stabilized under drier conditions. The laying of tiles for underdrainage is usually deferred until conditions are favourable, but experiments are being carried out to ascertain whether this interval can be reduced to allow the land to be cropped before the usual five-year interval. The improved marsh grass is grazed during this time and levelling and other work is carried out. Then follows ploughing and cultivation in readiness for cereal crops, sugar beet and potatoes. Calculated risks have to be taken and crop failures accepted in the process but excellent crops and high yields are the ultimate reward for perseverance and hard work.

In spite of the use of modern machinery the cost of enclosure is increasing. The opinion of one drainage engineer that the cost per acre for embankment could be from £150 to £250 depending on the amount of land being enclosed is supported by actual costs in a recent reclamation scheme. Some 700 acres of marsh requiring 3½ miles of sea walls has cost about £150 per acre and £100 per acre for ancillary works such as roads, culverts, ramps and ditch drainage. Underdrainage costs are estimated at £50 per acre. A smaller area of 300 acres has cost about £260 per acre with two miles of sea wall being built. Ditching and fencing costs are £40 per acre. No expenditure is likely to arise on farm buildings as the reclaimed land is worked with adjoining equipped farms. An owner has to accept a low return on his outlay for a few years until his tenant is able to bring the land into full production to allow him to pay an economic rent. With land in this marsh area realizing from £350 to £500 per acre and even £600 at a recent sale who can say that an owner is not wise to invest his capital in reclaiming land from the Wash.

This article has been contributed by **C. F. Bycroft, A.R.I.C.S., A.A.I.,** who has been Resident Director, Sutton Bridge and Holbeach Farm Settlements, Lincolnshire, for the past seven years. The estate comprises 6,500 acres with 237 equipped holdings all on reclaimed land.

Storage of Pesticides

Careless storage of pesticide products can lead to accidents. Users are reminded that full and partly-filled containers should be stored under lock and key away from food, feedingstuffs, seeds and fertilizers where neither children nor animals can get at them, They should ensure that the containers are tightly closed, that they do not leak and are clearly and indelibly marked to show what they contain.

8. Cornwall

A. L. Jackson

SMALL farms are a predominant feature of Cornwall, but small incomes are becoming less readily acceptable. In a county where grass behaves so kindly there is a growing urge to cash-in on nature's generosity in the most profitable manner, namely, by keeping more dairy cows. At the same time there is the urge to increase the return from those classes of livestock that make no demand on land, such as pigs. All this has to be achieved in the face of limited supplies of labour and capital.

A good example of how this ambition is being achieved is to be seen on Treheath Farm, Dobwalls, near Liskeard. This is a 58-acre all-grass farm, lying on a fairly well-drained fertile soil, with a grazing season that can extend from April into November, and is typical of conditions in much of Cornwall. It is managed by Mr. Michael Higman, who recently took over from his father, on returning from a spell at Bicton Farm Institute.

The position before development

At this time, father and son managed some 39 cows and 12 followers and fattened the progeny of some 40 sows mainly to pork. It was a full-time job mainly because the cows had to be batch-milked in one small shippon and housed in several separate buildings. Despite this handicap they achieved gross margins per cow of £90, and per sow of £40, and consequently quite an attractive income from 58 acres.

The development

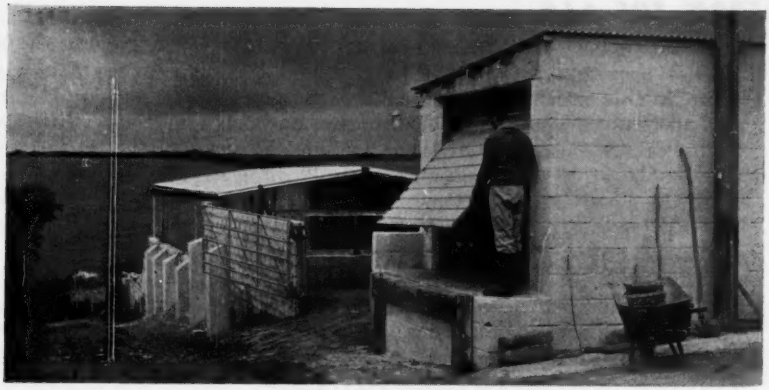
However, Mr. Higman was determined to make life a little easier and cut out some of the milking chores. After careful consultation with the N.A.A.S. he devised a completely new dairy layout which he erected on a fresh site in 1966. This was a 60-cow kennel block separated by a concrete loafing and feeding yard from a fixed six-stall Hosier Bale and two diversion boxes. The layout was built on sloping ground and was capable of lateral extension and, in fact, at the moment, is being extended to 80 cows. The slurry yard was at the lower end of the kennels, through which the slurry was pushed.

This layout was erected by outside skilled labour supervised by Mr. Higman at the remarkably low net cost of £42 per cow.

The old cow buildings were subsequently cheaply converted for sow housing. The development has considerably simplified management and enabled Mr. Higman senior to retire, and warranted taking on a young man to help milk the cows.

The results after one year

By April, 1967, it had been possible to increase the cows to 65 and the sows to 46. All herd replacements were being reared away from the farm



This picture shows the farmer (Mr. Michael Higman), part of the new dairy layout and part of the farm

under contract. The grazed stocking density had reached the proportions of 0·9 farm acres per livestock unit but contract charges for such items as silage-making and dung and fertilizer spreading had increased to £450 and forage purchases to about £500. Despite these higher costs the gross margin per cow had increased 28 per cent to £115 which was largely accounted for by an increase in milk sales per cow (to 971 gallons per cow) and a reduction in purchased concentrates per gallon (to 2 lb per gallon).

The consequent intensified use of the paddock grazing had necessitated a lime and fertilizer cost of £14 an acre (including more than 200 units of nitrogen), a reduced production of conserved grass at home and an increase in forage purchases. The net financial result of these changes in production and costs was to improve the return on tenant's capital to 20 per cent and to increase net farm income by about £1,000 per annum.

The physical result of the changes in organization was most obviously apparent in the improved confidence and satisfaction of the farmer, who now had more time for reflection and planning.

The future

The original target was to aim for 70 each of cows and sows on 58 acres. Eighty cows is likely to be achieved fairly soon giving a stocking density of 0·7 farm acres per livestock unit with a purchased forage and fertilizer cost exceeding £1,000 per annum, and producing a gross margin per farm acre from cows alone of £150. This is double that existing before development.

Financially, this is the type of result that the N.A.A.S. needed locally to propagate their belief that intensification is the salvation of the small farm. It is not difficult to demonstrate this sort of development—there is a continuous stream of visitors to the farm eagerly examining every feature of the enterprise which has become a blue-print for similar developments on other farms. The N.A.A.S. is, therefore, grateful to Mr. Higman, not only for his pioneering energy but for the courtesy he has shown in dealing with his farming visitors.

These intensive systems are providing the N.A.A.S. with an opportunity to study the physical consequences of intensification about which little is known.

In this article the author discusses recent legislation affecting agricultural farmhouses and cottages

Agricultural Dwellings

E. Wightmore, *Agricultural Land Service, Cardiff*

IN present-day conditions an agricultural cottage up to modern standards can be a valuable asset to a farmer. Whether the farm is situated in the remotest rural area or within easy reach of other industries, the retention of good workmen may be very largely dependent upon the availability of suitable accommodation. Nevertheless, the total labour force in agriculture has been declining markedly in recent years, due in part to improving efficiency of labour use, and many cottages have consequently become surplus to the requirements of individual farms. Similarly, as a result of economic forces, amalgamations of farms have been proceeding at the same time, and landowners and farmers are frequently being presented with the question of what they should do with redundant farmhouses.

The common desire for a 'place in the country' does, however, provide a ready market for properties of this kind and in the event of a sale being the most practicable course to take, the proceeds can be a useful source of capital for other agricultural purposes. On the other hand there is the possibility that a dwelling house surplus to immediate requirements, whether it be on a single farm or part of a larger estate, might sooner or later be needed again; and, in given circumstances, there could be just as much virtue in the longer term by having strategic flexibility with regard to labour use as to other factors of production. Moreover, there may be reasons, for instance tax status or a tenancy for life, for which the present owner would not, or could not, contemplate a sale.

Before, however, the letting of an agricultural dwelling is arranged on a temporary basis it is advisable to take note of recent enactments, to avoid creating a tenancy which would be entirely protected by the Rent Acts. As a general rule by far the greater number of farmhouses or cottages are excluded from these Acts. If a farmhouse is occupied by the tenant of an agricultural holding he is protected by the Agricultural Holdings Act 1948. An occupier of a service house or tied cottage occupies by virtue of a licence, normally without making any payment except by way of a small deduction from wages under the Agricultural Wages Act 1948, and has no security of tenure although he is given a small measure of protection against eviction by the Rent Act 1965.

The letting of a temporarily redundant farmhouse or cottage can, however, come within the full protection of the Rent Acts unless specifically excluded beforehand by the serving of the necessary notices. But the procedure should not be confused with an application to a Local Planning Authority which would be necessary if the farmhouse had been built or altered with planning permission, subject to restriction of occupation to a person engaged in agriculture. Removal of a restriction of this kind would, of course, be pre-requisite to either a sale or letting to a 'non-agricultural' person.

At this point it is helpful to take a look at the relevant statutes. Fortunately the sections to apply are few in number. Firstly, for the purpose of this article, a 'regulated' tenancy means a tenancy of a dwelling house of a rateable value which does not exceed £200 per annum—in Greater London £400 (Section 1 Rent Act 1965). This would seem to include the bulk of farmhouses and cottages. Secondly, there are special provisions in the Rent Act 1965 to facilitate recovery of possession of dwellings let on regulated tenancies which have previously been occupied either by the owner (Section 14) or by a person employed in agriculture under a contract of employment and so occupied under the terms of that contract (Section 16). But in either case the possibility of recovery for the purpose of sale with vacant possession can be ruled out.

If possession of a farmhouse is sought by the owner who has occupied the house as a dwelling house and has subsequently let it on a regulated tenancy, and the court is satisfied that the dwelling house is required as a residence for the owner-occupier, *or any member of his family who resided with the owner-occupier when he last occupied the dwelling house as a residence*, an order can be made for possession. But the proper notice must have been served. Similarly, possession of a previously tied cottage may be obtained when it is let on a regulated tenancy to a person other than an agricultural employee or ex-agricultural employee of the farmer* or the widow of such employee or ex-employee, if the court is satisfied that the cottage is required by a person employed or to be employed by the farmer in agriculture. Again the proper notice must have been served. In both cases the essential point is that *not later than the commencement of the tenancy* notice in writing that possession may be recovered (under either Section 14 or Section 16) must be served on the tenant.

It should be particularly noted that the machinery in Sections 14 and 16 does not apply to a farmhouse which has previously been occupied by a tenant of a holding. There is, however, provision in the Agriculture Act 1967 (Section 38) for the temporary letting of a farmhouse in the special situation of its becoming surplus to agricultural requirements following an amalgamation approved under Section 26 of that Act, even though at the time when the proposals were submitted it is occupied by a person other than the owner, if such a person was responsible for the control of the farming of land comprised in the amalgamation; in these circumstances, therefore, the occupier might be an 'owner, tenant or servant or agent of another'. The farmhouse may, with certain exceptions, be let on a regulated tenancy with a right to recovery of possession if required for occupation for a person employed, or to be employed, by the farmer provided (*a*) *not*

*It does not matter whether the farmer is the owner or the tenant of the farm provided he is the 'landlord' of the cottage.

later than the commencement of the tenancy the tenant has been given notice in writing that possession may be recovered under Section 38 and (*b*) proceedings are commenced within specified limited periods.

It is difficult to find a well-worn path through the labyrinthine growth of the legislation affecting dwelling houses which has been enacted on so many occasions since 1914. This article draws attention to the importance of serving proper notices where recovery of possession of agricultural dwellings to be let temporarily is intended at some future date. However, it would be wise to seek professional guidance *before* a letting takes place if any doubt at all exists as regards the steps it is necessary to take.

Agriculture (Miscellaneous Provisions) Bill

Measures to safeguard the welfare of livestock on farms (especially those reared by intensive livestock husbandry methods), to increase the compensation payable to tenant farmers whose land is needed for development, and to revise drainage rates and drainage charges on agricultural land and buildings in England and Wales are set out in the Agriculture (Miscellaneous Provisions) Bill on 2nd November, 1967.

Welfare of livestock

The Bill gives effect to the Government's decisions, announced on August 5, 1966, on the recommendations in the Report of the Brambell Committee. The main purposes of the legislation are to supplement for farm animals (especially those kept under intensive husbandry conditions) the general protection afforded to domestic and captive animals by the Protection of Animals Act.

Compensation for tenant farmers

The Bill gives effect to the Government's proposals, announced on 21st February, 1967, for special payments, equivalent to four years' rent, to be made to a tenant farmer who is displaced for development, forestry or any other non-agricultural purpose, whether he is displaced by a private landlord or by a public authority exercising compulsory powers. The payments will be in addition to any compensation payable under existing legislation and will, in effect, give the tenant five to six years' rent compared with the one to two years' rent now payable as disturbance compensation under the Agricultural Holdings Acts.

Drainage charges

The Bill implements the changes in the arrangements for levying drainage charges by river authorities in England and Wales. These change the basis of assessment from Schedule A valuations to acreage and make the general drainage charge more closely equivalent than at present to the contribution which the general ratepayer makes to the river authorities.

Drainage rates

The Bill enables internal drainage boards in England and Wales to revise assessments (at present based on valuations for Schedule A Tax) which are seriously out of line with those on comparable properties in the district.

Other provisions

The Bill contains a number of other provisions, including specific legislative authority for:

(1) The introduction of schemes for payment of a grant on field beans and other break crops. The Government's intention to provide a grant for field beans was announced at the 1967 Annual Review.

(2) Stabilisation arrangements for the bacon-curing industry announced on 12th April, 1967.

in brief

- **Future for dried grass**
- **Air pollution**
- **Early potato harvesting**

Future for dried grass

ALTHOUGH grass drying has been going on for many years, the high cost of the product has retarded its full exploitation. For the most part its use has been restricted to non-ruminants, but an increasing number of people are taking the view that the more attractive price at which the modern larger plants can now produce a high quality feed in a suitable form may extend the market for it as the basis of winter feeding rations. Trials to evaluate the feeding value of dried grass are already featured in the programmes being pursued at the Great House (Lancs.) and Bridget's (Hants.) Experimental Husbandry Farms.

Mr. Walter Smith, Director of N.A.A.S., speaking at the annual conference of the Association of Green Crop Driers at Scarborough, pointed to the opportunities that the producers of dried grass might grasp in an era of farming when intensification is becoming progressively the keyword to greater productivity. In the past, he said, intensive systems with beef cattle have foundered mainly on the high cost of feeding, but if the use of dried grass can reduce the cost of the ration significantly, intensive fattening systems may once again develop. The only way in which beef production can be really profitable is by using grass intensively, i.e., by grazing at high intensity and by feeding high quality grass products supplemented by cereals in winter. All the evidence from the Experimental Husbandry Farms proves this.

On the smaller dairy farms, too, where a major conservation policy is difficult and reliance is placed on moderate hay and fairly heavy (and costly) feeding of concentrates in winter, dried grass products might well play a more important part.

He directed attention also to the better upland areas. The uplands and lowlands are no longer so closely integrated as they were. The decline in lowland breeding flocks and the increasing number of lowland farmers who buy their animals as calves, rather than stores, and carry them through to slaughter has reduced the upland farmers' market in the lowlands.

'The size of the lowland market in the future', said Mr. Smith, 'depends on the economics of the feedlot system and the acreage of grass and forage crops in the lowlands. But the uplands have not yet been intensified to any great extent, and the better land of these areas has potential. One of the difficulties is the conservation of fodders because of weather or contour or cost and, on the high farms, limited areas of good land. Purchase of hay is an unreliable business because of variability in cost and quality. Can dried grass products form the basis of winter supplements (at reasonable cost) for upland cattle and sheep?

'I believe the intensification of livestock production based on better utilization of the grassland of this country presents the greatest challenge of the next decade. The rewards to the industry can be great because of the enormous potential which exists. It has been shown that it is possible to obtain more than four tons of digestible dry matter per acre, and, in comparison, the yields from cereal cropping pale into insignificance.'

Air Pollution

The latest report* of the Agricultural Research Council shows that our knowledge of the degree and effect of atmospheric pollution on crops and soil is growing apace; and the methodical national survey of the incidence of smoke and sulphur dioxide, which was started in 1960, is making an important contribution to it. The level of smoke emission is no longer seen as a danger to agriculture and horticulture now that the combustion of fuel by factories is so much more efficient; diesel and electric locomotives have replaced steam engines on the railways, and less coal is being burnt in domestic grates.

Oxidant smog is thought by some people to be a potential trouble in Britain. This is the kind of damaging pollution that envelops Los Angeles and other parts of America and is derived from the incomplete combustion of liquid fuels. But, because of our different climatic conditions, it is the opinion of the authors of this report that oxidant smog capable of damaging plant life would probably occur in Britain only occasionally, and then in limited areas where the density of traffic is high.

Sulphur dioxide, which comes mainly from the combustion of solid and liquid fuels, appears to be a greater problem, and although there has been a marked reduction in the emission of this chemical during the past ten years from domestic and industrial sources, it is expected that 'it will increase appreciably in the next few years with the establishment of more large coal or oil-fired power stations.' The introduction of natural gas may further reduce domestic and industrial output of sulphur dioxide, but this, it is said, 'is unlikely to be of equal magnitude.'

Where crops are grown close to main roads, lead pollution by motor vehicle exhaust fumes is another hazard that is being watched, but we need more information about the many factors which would complicate any detailed investigation into this form of contamination. Indeed, the whole problem of the toxic level of air pollution of plants and soil is extremely involved under the diverse conditions of season, light intensity, temperature, humidity, etc., and the individual susceptibility of plant species.

Early potato harvesting

Because of the need to minimize loss and the risk of damage to the tubers, most early potato growers still prefer lifting by hand—and this notwithstanding the perennial headache of labour difficulties and cost—to lifting by machine. But help may be at hand if the universal vegetable harvester developed by the National Institute of Agricultural Engineering can be adapted to the job.

The modification which the N.I.A.E. is working on to deal with early potato harvesting employs a combination of attachments already embodied in the machine —the pick-up belts for Brussels sprouts, the carrot-topping rollers and powered root-harvesting shares. The principle envisaged rests on the fact that immature potatoes hold much more firmly to the haulm than do the more mature tubers. The shares are specially designed to get well under the crop and thoroughly loosen the tubers; then the whole plant is transported by gripping belts to the contra-rotating rollers at the top of the belts. There the tubers are rubbed off, put over a soft rubber roller cleaner and delivered either into boxes carried on the harvester or into an elevator for side delivery into a trailer.

AGRIC.

**The Effects of Air Pollution on Plants and Soil*, price 6*s.* from the Agricultural Research Council, Cunard Buildings, Regent Street, London, W.1.

Books

Commons and Village Greens. D. R. DENMAN, R. A. ROBERTS and H. J. F. SMITH. Morgan-Grampion Books, 1967. £7 7*s*.

The registration of common land and rights and of village greens is going busily ahead under the 1965 Act. By the early 1970s, when the work of implementing the first set of recommendations by the Royal Commission (Cmnd 462) will be complete, there will be a twentieth-century Domesday of all common land and village greens in England and Wales.

The present volume by three distinguished authors, each expert in the use of agricultural land, looks forward to the legislation that will be necessary to carry out the Commission's remaining recommendations on the future care and management of common land. With the generous support of the Nuffield Trust and the Land Economy Department of Cambridge University, the co-authors have taken a wide cross-section of such lands and conducted detailed surveys of 439 of them over the past six years. These they have classified into sixteen main groups according to certain broad geographical and ecological features. Another five groups bring together a variety of minor lands that were mostly set aside for specific purposes, allotments for the poor for fuel or cultivation, pits for gravel and other mineral extraction and village greens. Finally, the field surveys are rounded off with a chapter on five geographical complexes of commons of special importance and difficulty.

From their study and analysis of the use, potential and management (or lack of) the authors have deduced codes of practice for which provision they believe will need to be made if commons and greens are to be put to more beneficial use. They recognize that, where there is so much variety, local adaptation will be required. Their studies show that even today formal arrangements for management may be no guide to the condition of a common. A committee of commoners may do its work well or badly, stinting may be enforced but may yet not be to the benefit of the land. The survey also reveals that the extent and location of public use are more variable than has often been supposed. With this in mind, the authors prefer that the provision for public access should be examined in the context of each proposal for a management scheme and not conferred, as the Royal Commission recommended, as a blanket right. Where in this shrinking island there are so many interests to be catered for—agriculture in its different forms, forestry, nature conservation, mining and so on as well as public recreation—the case they make clearly deserves the same careful study that characterizes their own work.

This is, above all, a work of scholarship, practical as well as thorough. It is a mine also of off-beat information. From one turbary, turves are taken for the graves of commoners and their families. From a common in North Wales bracken was harvested until 1860 for ashes used in soap manufacture. These are two titbits among many.

Finally, the work represents an exercise in co-operation, not merely between the three authors, the Trust and the University, but between a good many other institutions and individuals as well, and as such it may serve as a model to commoners and other interests. For, if the hopes of this volume are to be realized, it will call for co-operative effort of a high order.

G.L.W.

Beet Sugar in the West. A History of the Utah-Idaho Sugar Company, 1891-1966. L. J. ARRINGTON. American University Publishers Group, 1967. 56*s*.

The history of sugar beet cultivation has a political as well as an agricultural interest. 'Boom, Bust and Bail out'—a racy chapter title in Professor Arrington's book—sums it up neatly. The idea of a beet sugar industry at home makes at first a strong appeal to any Government. It means import savings, more rural jobs and a rise in farming standards. Then colonies come into being often in tropical climates favourable for cane sugar production. The latter enterprise becomes the mainstay of the colonial economy and the Government then must cut back on domestic sugar production to keep its colonial producers sweet—if such

is an appropriate metaphor. This is an oft repeated story in European countries and in the U.S.A.

The remarkable feature of the Utah-Idaho Sugar Company, whose seventy-fifth anniversary has been marked by the publication of a very readable 'company history', is that the original project was sponsored not by Government interests but by a religious sect—the Church of Jesus Christ of Latter-day Saints, more commonly known as the Mormons. The prime object was to provide jobs for the faithful, 'independent of Babylon', at a time when the members of the church were finding themselves excluded from many industrial or public service occupations. From small beginnings in 1891, twenty years before the first factory was erected in this country, the company now operates plants at thirty sites in the Mountain West. This advance was achieved not without adventures, notably the early shortage of capital and the collapse in prices after World War I when the Americans in their turn had to reckon with colonial cane sugar interests. The difficulties were not always financial ones. At one time the whole future of beet production in these states was jeopardized by Curly Top virus but the industry was saved by the breeders' success in developing strains resistant to the disease. A feature of beet cultivation in the Mountain West has been its association with irrigated agriculture. It was these farming pioneers in Western U.S.A. who demonstrated the potential benefit of irrigation for beet, and refuted the common belief in Europe that watering would so reduce sugar content and purity that the crop would be unfit for processing.

Commissioned histories of commercial undertakings can be fulsome, or dull, or biased, or all three. However, the author has avoided these hazards and tells a straightforward story of how the fortunes of a single sugar company were linked with the industrial development of Western America in the first half of the twentieth century.

P.N.H.

Marketing of Agricultural Products. RICHARD L. KOHLS. Collier-Macmillan, 1967. 70*s*.

This is the third edition of Dr. Kohls' book. The two previous ones were published in 1955 and 1961. The book is intended for people with little or no training in elementary economics. Its purpose is to provide starting points for students of agricultural marketing.

Dr. Kohls divides his material into three main sections. 'The Framework of the Marketing Problem' defines marketing and its scope. It contains a brief description of the consumer market for agricultural products and the production unit. The second part, headed 'Some Functional Problems', deals with price, demand, supply and cyclical and seasonal price variations. The role of government, agricultural pricing programmes and the traditional functions of marketing are also discussed. The third section is called 'Commodity Marketing and Problems'. Livestock, dairy, poultry and egg, grain, cotton and tobacco marketing are described, together with the role and problems of agricultural co-operatives.

The book thus attempts to describe the entire agricultural marketing sector of the United States economy in a simple and understandable manner. The author's intention is indeed worthy. Problems of marketing should be presented in as simple a manner as possible so that the student will acquire a greater understanding of the nature and complexity of the marketing system.

In striving for brevity and clarity, the author has tended on occasions to oversimplify to such an extent that the reader is sometimes left with a false impression of the nature of the problem or the possible solutions. This criticism is especially pertinent for the English reader who is probably not well acquainted with the American examples chosen throughout the book. In some instances, statements have been made which are incorrect. 'If the law of demand is valid, the demand curve will always slope downward and to the right.' Similarly, '. . . the supply curve will always slope upward and to the right'. Both these statements are not always correct. Even though the book is written for elementary students who might not be interested in an exposition of backward-sloping supply or demand curves, the fact that they exist should be recognized.

It is possible that the undoubted value of this book as an introduction to agricultural marketing would have been enhanced if more emphasis had been placed on economic principles and less on commodity marketing channels. The reader would then be in a better position to recognize and understand the problems of marketing. However, Dr. Kohls seems to have anticipated such criticisms in the preface for, in reply to the opinion of some of his colleagues that the text is too

elementary, he says, 'In the final analysis, texts should be written for students, not for our professional colleagues'. The fact that the book is in its third edition probably proves him right.

R.C.R.

Nutrient Requirements of Farm Livestock. No. 3. Pigs: Technical Reviews and Summaries. Agricultural Research Council. H.M. Stationery Office, 1967. 30*s*.

The formulation of diets for farm animals requires that there should be available a clear indication of the nutrient needs of the animal and an awareness of the contributions that can be made by the array of potential ingredients that are available. The Agricultural Research Council, in collecting information on the nutrient requirements for farm livestock, is making a substantial contribution to assist efficient formulation. The publications that have already appeared constitute a very impressive review of the data available. The third review, concerning pigs, is eminently suited for broadening the knowledge of the technical specialist in the field of animal nutrition and makes an admirable tool for the training of students. It does, however, seem likely that the information falls a little short in assisting the processes of actual formulation in the field.

It is possible that one of the greatest problems in dietary formulation for farm animals is to give a clear indication of the objectives. These must obviously be ultimately aimed exclusively at commercial expediency. Such an approach very seldom has overwhelming prominence in experimental work devised to establish requirements. Outstanding performance in a parameter of commercial importance has seldom been the criterion for establishing nutrient needs. It is, therefore, difficult to identify allowances for a particular commercial objective. Some slight criticism can be made of the A.R.C. publications on the grounds that this disparity in objectives is not clearly recognized.

A plea is made in the introduction concerning the inadequacy of data available on protein—energy interactions in pig diets and, in particular, the implications of this in regard to the carcass composition of the pig. There has been a substantial amount of work carried out in this area in recent years. The situation that has arisen emphasizes one of the most substantial criticisms that can be made of this work—the delay in publication. It is mentioned that only information available to the middle of 1964 is used. This probably means work carried out some two years earlier. Every effort needs, therefore, to be made to ensure that a time gap of this order—almost five years—is eliminated. Perhaps addenda produced at intervals would make it possible to reduce the gap between the conduct of experimental work and the inclusion of the results in a document of this sort.

The working party responsible for the publication of the nutrient requirements of pigs must be complimented on a mammoth task that has been carried out with very commendable efficiency. The publication will be of lasting value to applied nutritionists and the technical secretaries have clearly carried out a great deal of work. When the magnitude of the task is recognized the delay in publication is understandable.

D.L.

The Identification of Weed Seedlings of Farm and Garden. R. J. CHANCELLOR. Blackwell Scientific Publications, 1967. 15*s*.

There are now over 300 commercial chemicals available for controlling weeds in cereals. New introductions tend to be more stringent in their requirements for efficient use and more specific as far as individual weed species are concerned. Mixtures of herbicides have increased the range of weeds controlled by one spray. Weeds susceptible to M.C.P.A. and 2, 4-D are no longer a problem but their elimination has allowed an increase in the 'difficult' weeds more or less resistant to M.C.P.A. Modern developments in herbicides demand that weeds are identified at an early stage of growth so that the correct choice of chemical can be made, and this is important in view of the higher costs of new herbicides in relation to M.C.P.A.

The author's new book provides farmers, growers, advisers and research workers with a ready means of identifying the Dicotyledonous weed seedlings to be found on farms or in gardens today. It is a welcome revision and expansion of the publication *Seedlings of Common Weeds* (M.A.F.F. Bulletin No. 179) by the same author, which was the first such book to describe the seedlings of common British weeds in detail. In the new book some 162 species are illustrated, described and placed into 32 groups, and a simple identification key enables the seedling to be placed in its

appropriate group. Identification depends on the physical appearance of the seedlings, the shape and method of attachment of the cotyledons and first true leaves, the appearance of the leaf margins and the presence or absence of hairs, down or prickles on the leaves. Few botanical terms are used and these are explained adequately in the glossary.

Each species is given its Latin name and common name, but as many common names differ between localities not all can be included. To aid identification each species is given a short note on its occurrence, habitat and features which distinguish it from close relatives. One difficulty is the natural variation that occurs within a species and positive identification of closely resembling species may of necessity depend on factors such as the habitat or peak time of germination.

The author has included clear line drawings of each species though these are of necessity rather mechanical. Most seedlings are drawn looking directly down on to the plant, but some species with long narrow upright leaves are drawn side view. Where appropriate, hairs and prickles are drawn clearly at natural density.

This modestly-priced book is indispensable to all concerned with the efficient application of herbicides today. It would have been preferable for the cover to have been made of stouter material as it will be much handled in the field.

J.F.R.

Books Received

Agriculture in our Industrialised Society. Chemistry and the nutrition of efficient farm animals. W. O. Brown. Queen's University, Belfast.

A Glossary of Terms used in Plant Breeding. Compiled by W. J. C. Lawrence. Horticultural Education Assoc. Copies from Gibbs and Sons, Orange Street, Canterbury. 2*s.* 6*d.* (including postage).

Kirton Experimental Horticultural Station. Second Report 1965. Ministry of Agriculture, Fisheries and Food. Copies free from the Director, Kirton E.H.S., Kirton, Boston, Lincs.

Fairfield Experimental Horticulture Station. Eighth Report 1966. Ministry of Agriculture, Fisheries and Food. Copies free from the Director, Fairfield E.H.S., Greenhalgh, Kirkham, Preston, Lancs.

Stockbridge House Experimental Horticulture Station. Report 1966. Ministry of Agriculture, Fisheries and Food. Copies free from the Director, Stockbridge House E.H.S., Cawood, Selby, Yorkshire.

Crop Technology I: Early Potato Production. Bulletin No. 10. M. Eddowes and R. C. Jefferson. Copies from Harper Adams Agricultural College, Newport, Shropshire. 5*s.*

Crop Technology II: Maincrop Potato Production. Bulletin No. 11. M. Eddowes. Harper Adams Agricultural College. 5*s.*

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This Centre is now a permanent feature of the National Agricultural Centre at Stoneleigh. It affords a display of fundamental techniques in the use of electricity in agriculture, as well as providing conference and training facilities. In addition, there is a technical and product information library also adequate provision for demonstrating new equipment. This new Centre has been established by the Electricity Council to help farmers keep up to date with the latest electrical developments in agriculture. It operates in conjunction with the Demonstration Areas of the N.A.C. where electrical methods are widely demonstrated as part of the many new farming techniques. Advice and information about electric farming methods is freely available from the full-time specialist staff in attendance. Intensive training courses and conference facilities are also available for use by recognised agricultural organisations. The new Centre is designed to meet the needs of all sections of the agricultural industry and to assist farmers in their efforts to increase productivity and cut costs.

For further information, contact Mr.R.G.Scott at the Electro-Agricultural Centre, National Agricultural Centre, Kenilworth, Warwickshire, CV8 2LS. Telephone: Coventry 27338 or your N.A.A.S. and A.L.S. County Office.

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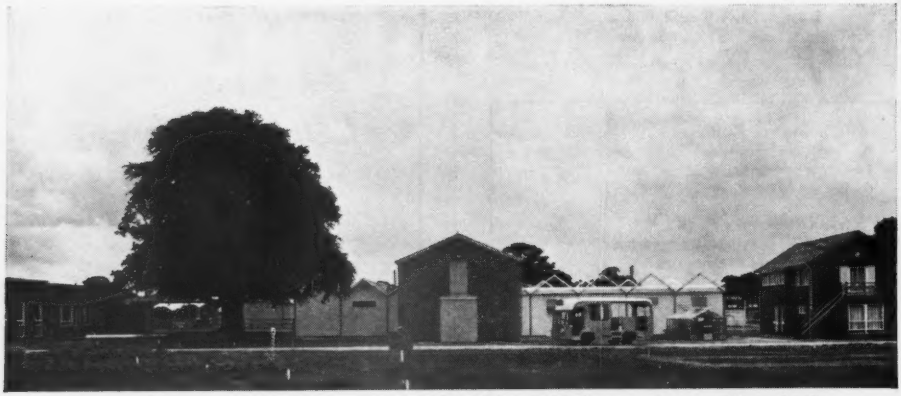

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